

Simple Instructions for Beginners This Issue

# Radio Digest

## Illustrated

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E. C. Rector

CHICAGO, ILL., SATURDAY, APRIL 15, 1922

PRICE TEN CENTS

## RADIO TALKING MOVIES

### SCIENCE TRIUMPHS IN RADIO RECORDS

NEW INVENTION RECORDS  
ARTIST'S VOICE BY RADIO

B. P. Messner, Inventor of "Electric Dog," Beginner High Co's of Mme. Dut

"B. P. Messner of the experimental phonograph firm of the New England Colander Company, has succeeded in recording successfully Mme. Dut's dogue high Co by Radio.

"The result," said Mr. Messner, in commenting on the triumph, "is that when the record is put on for fire-side entertainment, those who hear it will get all the voice and go, the first high note which is only to be obtained by a singer's effort. Finding a great audience for her initial appearance, her rendition is naturally more inspired than when she is merely standing in front of an unresponsive screen that gulps down her words."

The opera star, in making the record, sang to the stage of the Chicago grand opera company to the usual audience, with the exception that at the audience was a transmitter sending her voice waves, via Radio, to the New England Colander recording laboratory.

### General Squires in New Patent Suit

Alleges American Telephone and Telegraph Company Infringed His "Guide Wave" Rights

WASHINGTON.—Suit has been filed in the United States District Court for the Southern district of New York by Major General George G. Squires, Chief Signal Officer, U. S. A., against the American Telephone and Telegraph company claiming the infringement of several patents he holds for radio inventions.

The patents that General Squires claims to be infringed are on those that permit radio communications to be "guided" through the air instead of being broadcasted indiscriminately, and further permit the sending and receiving of several radiophones or telegraph messages over a single wire.

### CHICAGO SETS RADIO SHOW WEEK, JUNE 26

ANNOUNCEMENT has been made by Miss E. Westmark of a Radio Show to be held in Chicago from June 26 to July 1. The show will be held in the Auditorium. In addition to manufacturers' displays there will be shown the few radio parts necessary for the beginner to put together the "Junior Radiophones." Demonstrations will be given daily on receiving and sending so the working parts will be understood.

RADIO GOOD MORNING KISS  
SENT THIS CHARMING MISS



© C. & U. M. T.

Ethel Martz, in Her Room, McAlpin Hotel, New York, Receiving Her Radio Morning Kiss from Her Sweetie in Brooklyn, N.Y.

### Thief Steals Receiving Set; Police Looking for Antenna

PEORIA, ILL.—The first theft of a radio set was reported to the local police. George Roscoe, 116 Harrison avenue, complained to the police that some one had ranched his horse and taken a radio set with him. Police are investigating to see whether the antenna was stolen.

### MICHIGAN ALUMNAE WILL HEAR GLEE CLUB

April 29th Set as Date for "Michigan Night" Broadcasts

The University of Michigan has set April 29 for the "Michigan Night" program, which will be broadcasted to Michigan alumnae. The program will last two hours and will consist of talks by President Burton, Coach Yost, Football Captain Don Carl Johnson and Eddie Viek, former track stars. The varsity band, glee club, mandolin and guitar club will play.

### CHICAGO MAN SUCCEEDS IN SYNCHRONIZING MOTION PICTURE AND RADIO VOICE OF WELL KNOWN ACTOR

H. Powers, Jr., Registered V.  
Bacon, "Lightnin'" Star, in Moving  
Pictures with Aid of 9 CT

The talking movie via Radio are here. The success of the first experiments in producing Radio talking moving pictures has just been announced by the inventor, H. L. Powers, Jr., associated with the Strangler theatrical interest in Chicago. Synchronizing the human voice with moving pictures and broadcasting this voice to a receiving station was recently demonstrated successfully in the Colonial Theater with Frank Bacon, the master actor of "Lightnin'" in the stellar role.

**MAN AT P.C.T.**  
Mr. Bacon, who had previously posed for the moving picture film to be used in the demonstration, was installed in the sending room of station 9 C T, located in the lower of the Wrigley building. A small moving picture machine and the sending apparatus of the station served as his audience. At the Colonial theater another audience waited before a receiving set with loud speaker and a projecting machine prepared to show a duplicate film of the picture shown at the Wrigley building. As a preliminary the receiving set was tuned in with 9 C T and a Victrola record of Mr. Bacon's voice was heard. At exactly 6 o'clock in the afternoon a signal was given and both moving picture machines were started. Mr. Bacon's voice was heard at the same time the picture was shown on the screen at the theater.

To Synchronize with Cook

Synchronization of the voice via radio and the pictures is being developed by Mr. Powers with a single cross-wire device. Synchronizing a synchronous motor for the projector now used in the ordinary projecting moving picture machine will eliminate the human element that entered into the first experiments and will make the registration automatic.

#### Pictures and Voice Register

In the film used for the experiment Mr. Bacon was shown breaking a water glass, ringing a bell, blowing a whistle, firing a revolver, etc. In the preliminary test the sound effects and the voice were heard at the same time that the pictures appeared on the screen. On repeated tests and experiments conducted during the evening the voice and sound effects registered perfectly with the film.

#### Talking Movies in Motion

The invention of talking motion picture via Radio opens up vast of possibilities in the box. It will be only a short time (Continued Page 2)

### Keeping Fit by Radio To Be Broadcasted

Series of Calisthenics to Bring  
"Gym" Into Every Home

H. L. Powers, Jr., of the Colonial Theatre, inventor of the Radio Talking Movies, is soon to conduct a series of calisthenics via Radio. He will call his new course "Keeping Fit with Radio." By arrangements with the Illinois Athletic Club, located in the McCormick Building, and a broadcasting station, these exercises will be broadcasted at intervals during the day.

### BROADCAST BETWEEN ACTS

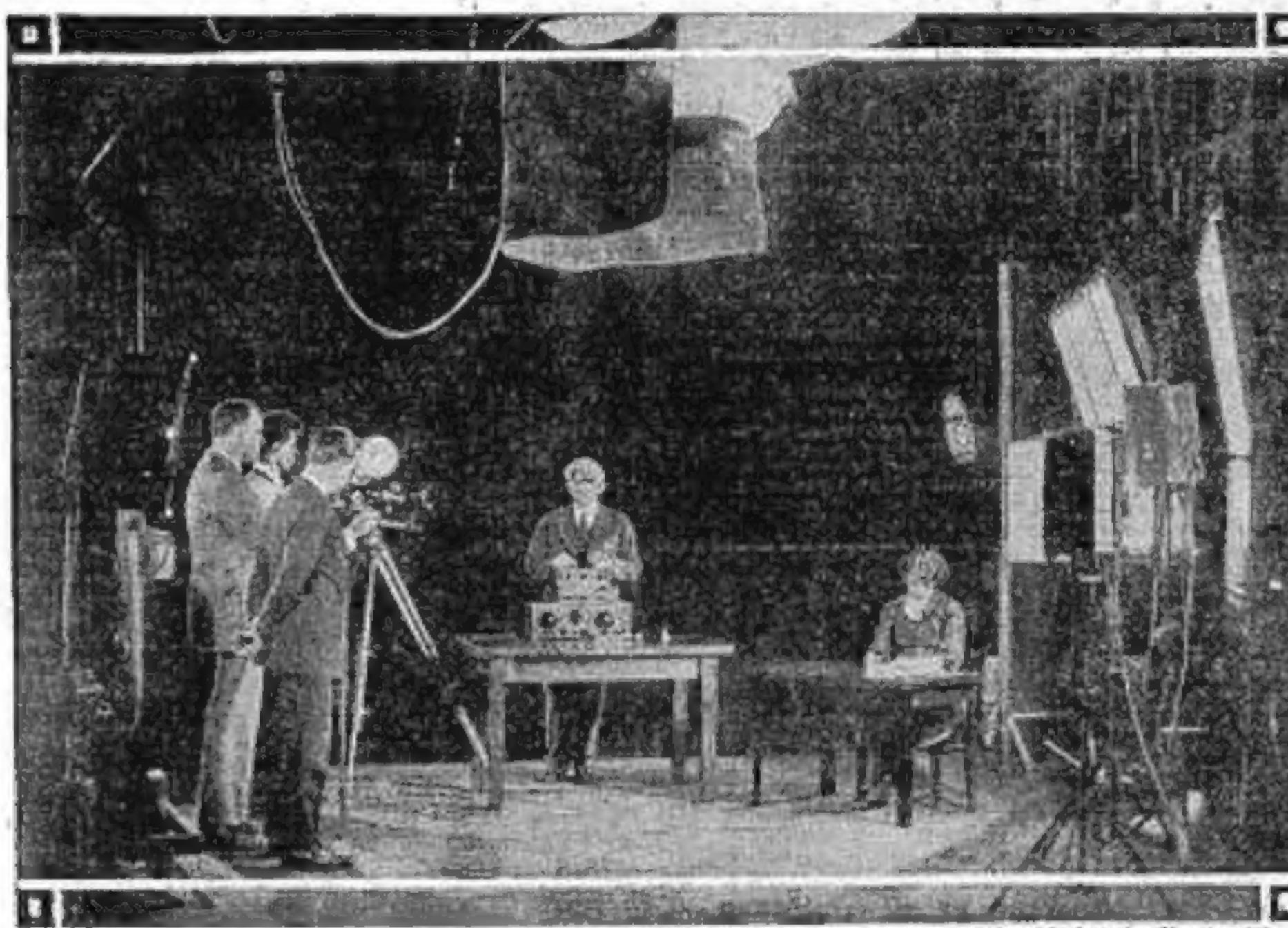
Music-Box Revue Cast Lists in on  
Other Shows

NEW YORK.—The cast of the "Music Box Revue" have installed a receiving set to get broadcasts between acts. As the other theaters install sending sets the cast plans to hear excerpts of the other plays they are unable to attend.

### NEWARK HOLDS SHOW WEEK APRIL 13 to 16

NEWARK, N.J.—A radio show will be held at the Hotel Robert Treat here April 13 to 16, inclusive. The Newark Leader in conducting the show and giving leaving copy will be awarded to the amateurs who build and exhibit the best and most unique receiving and transmitting sets. Musical radiophones concerto and talkies by men prominent in Radio development will be exhibited at the show.

## REGISTERS VOICE WITH MOVING PICTURES



Copyright Standard Film Co., Chicago

Beginning experiment that proved talking movies possible. Harry J. Powers (left), inventor, watched W. J. Rathbun direct Frank Bacon in short speech. The camera recorded Bacon's action and the stenographer took down his words.

## TALKING MOVIES

(Page 1)

... and Broadway hits can be enjoyed by the whole family while gathered around the fireside. A few twists of the knob on the receiving set after the lights have been dimmed and the automatic starting of the picture machine will bring the latest show right to the home. Grand opera will not only be heard but the artists will be seen, as they warble their aria in the auditorium.

Talking movies by the aid of radio will not only bring joy to the home folks but the head of the house will enjoy them while traveling on a train or the ocean everywhere. Even the aristocracy at a talking movie or an airliner in a future possibility.

**Revolutionizes Amusement Business**  
"The perfecting of the invention of radio talking movies will revolutionize the amusement business," said Mr. Powers in commenting on his new discovery. "Any great size like Mr. Powers will be able to reach the masses. It will not only join the speaking stage but it has great possibilities. It will enable the poor as well as the rich to see and hear the greatest actors and operatic stars at prices far below the present price of theater tickets."

**Sermon of Such Power  
Radio Fans "Kick In"****New York Minister Surprised at Sum Received**

New York.—A recent offering sent back, cast by Rev. Ernest M. Spires made it possible to have an increased collection. Many checks were sent in by those who listened in on his excellent address, although they didn't regularly attend any church. The sum received was much more than that found in the regular collection boxes at the service. If this holds true, a great many churches will be able to solve their financial troubles by radiophone.

**COUNTRY CLUB GETS "BUG"****Members Cleveland Club Will Receive Broadcasts**

CLEVELAND.—One of the local country clubs here is planning to install radio sets for the benefit of members for their members. Members spending the weekends at the club will be enabled to while away the hours after a game of golf with the latest broadcasts. Local news and stock report broadcasts will especially interest the club members.

**Broadcast Favorites Draw Better Than All Other Theatrical Stars****Broadcasting Given Ballad Singer Larger Audiences Than Ever Before—Listening in Creates Desire Among Radio Fans to See Artist**

Usually miles are indicated by an unclassified service. This seems to work out well with actors who use radiophones in preliminary work. Artists who have performed before radiophones have had many constituents paid to them by letter. Later when they played a nearby city in person there has been an increased number of admirers present. They were eager to see the artist heard at home through their receiving sets.

**Tours Announced with Stars**  
A ballad singer on tour mentioned she would be pleased if her radio audience in any of the towns on her tour would speak to her after the performance. In every theater she has played since and at every performance there have been persons who have identified themselves as part of her radio audience. They paid admission just because she aroused their curiosity.

The psychology of all this is based on a creation of an unclassified desire.

**Well Worth the While**

The manager of a large Jacksonville circuit was rather sceptical about the method of advertising. When he was told how the newspapers would feel if the news were

brought free of charge he was told that the first feature of the daily program of the Metropolitan District of New York is an hourly summary of the news of the world with particular stories being laid on the local news, and that it has helped the papers' circulation wonderfully.

**"Our Mary" Has Personal Set**

San Francisco, Cal.—The grand opera manager and singer, Mary Garden, requested the hotel management of a local hotel to install a radio transmitting set for her use in broadcasting, while the opera season was on in the metropolis of the coast. It was satisfactorily arranged and now the radio fans of the coast will have the privilege of listening to her voice broadcasted from her radio station in her private hotel suite.

**College to Debate by Radio**

Ashland, O.—Only one debate in twenty-two years has been lost by the Ashland College. The debaters of this college have challenged Harvard, Cornell and Princeton by radio. It is intended that the contestants will remain in their own cities and deliver their speeches into the transmitters of their sending sets with the opponents and judges listening in at various points. Use of amplifiers will permit quite a number of persons to hear the debates.

**To Broadcast College Courses**

NEW YORK.—The New York University has announced the plans for the installation of a station at its Washington Square division for the broadcasting of educational courses. Classes will be conducted in all the various courses of the university and a college education at home by radio will be a fact when the station is placed in active operation.

**Listen In for Liberty Bell**

PHILADELPHIA.—It is planned at the Bicentennial Celebration to use the Liberty Bell and the sounds will be carried by broadcasting to all parts of the country. President Harding's address will also be sent out by radio.

**Good Antenna Is Lightning Rod**  
WASHINGTON.—The Bureau of Standards report there is no danger of lightning with antennas if correctly installed. The antenna really acts as a lightning rod and protects the building.

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## Looking Ahead

Benjamin F. Mizner, authority on radio, author of "Radio Broadcast" and inventor of the "Electric Day," will continue his interesting series, "Characteristics of Vacuum Tube Amplifiers."

Harry J. Marx will give more of his "Simple Instructions for the Beginner," and the hand-held sheets of the alphabet used in circuit diagrams.

Radiophone Broadcasting Stations will be larger and brought up to date. This feature is worth waiting for.

Person-to-person Broadcasts—the real you—will be illustrated every issue.

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# FIND MISSING YOUTH BY WWJ BROADCAST

Toledo Scoutmaster Gets Description Listening in on Detroit News Concert and Locates Boy

Detroit, Mich.—The Detroit News Radio Station (W W J) interrupted its concert long enough to give a description of a missing youth. The next evening after giving out the description the boy was on his way home in charge of his brother. His speedy return was due to the fact that a Toledo scoutmaster was able to put two and two together and get results.

Scoutmaster F. J. Lehman was listening to a concert at his son's radio station. The concert was interrupted to make a request that all members of the News Radio family assist a Detroit mother in locating her missing boy, Alton Truett. His description followed:

In a Saturday's paper, Dr. Lehman read an article about a boy at the Jacobsen Home who claimed to be named Stevens and have no living wife his aunt in Missouri. The man next said that no boy by the name of Stevens was missing, but that his nephew Truett had not been seen for some time.

The similarity of names caused Dr. Lehman to call up the Mairon at the home and the description of the boy there tallied exactly with that of the missing Detroit lad. Heribert Phillips' brother took him back to Detroit.

This is believed to be the first time radio has ever been used to locate missing persons.

## INVENTOR WINS HIS CIRCUIT SUIT

United States Court Decides in Favor of Armstrong and His Valve

NEW YORK.—Keween H. Armstrong has at last definitely established his rights as inventor of the circuit whose application in radio broadcasting has been as prominent in the past few months. The decision of the United States District Court of Appeals in favor of Mr. Armstrong, plaintiff, as against Lee De Forest, inventor of the Audion, or three-electrode vacuum valve, will create a niche for Mr. Armstrong in the history of radio.

It was in 1912 that he first developed his modification of the accepted three-electrode vacuum valve receiving circuit while still a Junior student at Columbia University. From that until now a decade has passed before he has received formal recognition of his work. After the decision, he remarked that he had one more thing to put over, after which he was going abroad for a rest. What he has in mind as the "one more thing" remains a mystery.

## Blame Ma's Shears in Phone Receiver Loss

PHILADELPHIA.—Many apartment owners here are reported to be suffering the loss of their telephone receivers in the lobbies of their buildings. The young radio fans have been purchasing the receivers by use of their mothers' shears. One owner is reported to have lost all his receivers in one raid.

## STATE CONVENTION IOWA CITY IN APRIL

A state radio convention will be held at Iowa City, Iowa, the latter part of April under the auspices of the Iowa University. Radio equipment houses will send apparatus to the convention showing the latest equipment.

This will be the first radio show in Iowa. The University officials are making elaborate preparations to make the Convention and Show a big success. A big audience is expected.

## ELECTRIC LIGHT IS USED FOR ANTENNA

### NEW INVENTOR OF MAJOR GENERAL SQUIER

Receiving Plug Inserted After Light Bulb Removed—Transmitting Connected Same Way

Washington, D. C.—Here comes a new invention in which the music, features and other sounds can be received without the usual antenna, the receiving set being connected directly to an electric lamp socket. If this proves efficient as it has on preliminary tests than there will be no question of radio broadcasting through the air. The tests were made and announced by the inventor, Major General Squier, the chief signal corps officer of the army.

Only recently, or within the past week, was this new discovery made and a public demonstration given at the signal corps headquarters. The whole operation of installing the device for receiving consists in removing the bulb from a lamp socket and inserting the receiving plug. The transmitting station is connected with the lighting system in the same manner.

The inventor will bring to every home having a lighting system a means of hearing concerns which previously have been broadcasted through the air and received through the antenna.

One of the main features claimed for this invention is that it will relieve congestion in the air, the bone of contention at the present time.

No doubt the sending of messages by this means would be somewhat limited, but the inventor says it is possible to broadcast over great distances. Such tests have not been carried out at this time. The reported invention is very new.

## Boy Makes His Own Set According to Plan

San Francisco, Cal.—"Now, I would not say one of these fixed up 'em," says Valentine Gilbert, a school boy of 14. "It's more fun to make your own. I can buy an antenna now, maybe. And perhaps I'll get a sending set, but no matter how much money I find I wouldn't trade my outfit for a ready-made."

Young Gilbert knew little of his parents until now came to him recently that a grandfather of his had died and left his son fortune of \$180,000. Now he thinks the money will spend all of his time. He says he is not going around buying things, as he gets more fun out of making them.

## KEEP FIRE BRIGADERS AMUSED BY CONCERTS

Village Stove Replaced by Receiving Set

Tuckville, O.—For the purpose of saving so his volunteer firemen, Fire Chief A. T. Malasky has decided to install a receiving set in the village building. The main object is to tempt more volunteers to pass around the municipal building, thus making them immediately available for quick action when the alarm is sounded. The chief expects the fellows to stick around listening to the concerts broadcasted from KDKA of Pittsburgh. But what will the chief do when there is no concert in the air and a fire breaks out?

## HOW TO BEGIN—

30° 30° 30° 30° 30° 30° 30° 30°

NUFF SED!





# WWJ FIRST NEWSPAPER PLANT

## DETROIT NEWS STATION ESTABLISHED AUGUST 1920 WITH THE DEFOREST TYPE

**Many Headliners Made Debut in the News Broadcasting Station—Some Showed "Radio Fright"—Frank Tinney "Spoofed"**

Significant in the development of radio broadcasting as a social service has been the remarkable reception of the daily concert and commercial reports of the Detroit News, the first newspaper in the United States to install a radio transmitting station as a part of its regular equipment.

Late in August, 1920, the News installed its first transmitting set and after ten days of exterminated experimental work announced to a wondering public that the local state and national congressional primary elections would be televised by the new station.

#### 45,000 Detroit Radio Fans

It has been estimated that today there are more than 45,000 radio sets in operation in Detroit as the result. Most of these have been installed within the past 12 months and the public interest in the progress of the domestic adaptability of the radio service in Detroit has been phenomenal.

Every weekday since its public announcement the News has delivered a varied program of music and oration to a constantly increasing audience. During the recent Lenten period this program has been featured by a special half-hour each evening in which a leading prelate told the drama of the meaning of the Word.

In its edition of September 1, 1920, referring to the announcement the day previous, the News said: "The settling of the election returns by the Detroit News radiophone Tuesday night was fraught with romance and added go down in the history of man's conquest of the electrons as a gigantic step in his progress."

"In the four hours that the apparatus, set up in an out-of-the-way corner of the

News building, was tossing and whirling its messages into space, few realized that a dream and a prediction had come true. The news of the world was being given forth through this invisible trustee to the waiting crowds in the unseen market place."

#### De Forest Type Used First

The original transmitter of the News consisted of a De Forest type OT-16 transmitter. The wave length used was 380. Under perfect conditions it had a range of 300 miles. At the time there were only 100 operators in the territory then reached. Two programs of phonograph music were broadcast daily—one at 11:30 a. m. and the other at 7 p. m. Only occasionally were speakers and singers used.

Reports from Detroit suburban communities that the concerts were being successfully received occasioned two and almost incredulous comment. When the steamer W. A. Newell, steaming in the night across Lake Erie, Cinc., sent a message to the Marconi station at Sarnia, Mich., thence relayed by wire, stating that the first concert actually was being wafted across the dark waters, interest was further heightened.

#### First Radio Dancing Party

Regarded as special at the time was a dancing party, sponsored by radio music, given in the home of G. T. Hammond, of Detroit. The service then extended itself to the War III the series. When, in October, 1920, the results of the world's series contest between Cleveland and Brooklyn were carried instantly to waiting fans. The first returns of a national election ever broadcast were sent out the following month, when Harding defeated Cox.

Concerts appropriate to the season were broadcast at Christmas time, 1920. The number of radio stations was rapidly increasing and many Christmas recordings, metaphorically at least, contained radio operators that gave tribute to the new creation.

#### Attorney Sung First Song

On New Year's day, 1921, a human voice for the first time, as far known, singing a New Year's melody of cheer, went out across uncounted miles through the invisible ether that is the medium of the wireless telephone. Louis Colombo, Detroit attorney and famous baritone, sent his resonant tones into the mouthpiece of the Detroit News radio set at midnight on New Year's Eve.

Another event that was regarded as an astounding achievement at the time was the receiving of a radio concert at a banquet held in the Detroit Masonic Temple. A three-wire antenna had been strung along the ceiling of the banquet hall.

#### Beginning of Theatrical Broadcasts

The original transmitter of the News and in the meantime had been raised inadequate for the growing requirements and had been practically rebuilt. A two-wire antenna, 189 feet in length, then was erected. As the result reports began coming in from points remote in the north and west that the concerts were coming through quite audible. Code messages from the U. S. Navy radio station built in Borkum, Prussia, and from stations in Nauen, Germany, and Hawaii were received.

During the summer of 1921 the phonograph concerts and news bulletins occasionally were supplemented by music and recitations furnished by theatrical talent. Edmund Vance Cook, the children's poet, was the first literary man to send out his compositions across miles of space via wireless.

#### Night People in Radio Department

In December, 1921, the News radio department kept 100 technical men and a program manager busy. The staff since has grown to eight persons. In December last the present ambitious program of the News was inaugurated. Phonograph music was relegated to an incidental place on the daily schedule and stage favorites were engaged to delight the numerous

radio listeners with their most popular offerings. Ernest Ball, composer of popular songs; Frank Tinney, comedian; Van and Schenck, Percy Weyrich and other headliners made their radio debut in the News radio auditorium. Market quotations have found a permanent niche in the daily program.

Stage favorites, perfectly at ease behind the footlights and in the spotlight, were succeeded by the diminutive little radio star that carried their numbers to thousands of homes. They chanted versions of "Radio Night." The new device was as much a mystery and a source of wonder as there as to any uninitiated visitor.

#### Frank Tinney Thinks It Does

Frank Tinney was so mystified that he naturally wondered if he was not being hoaxed. Once when he heard music relayed back from Windsor, Ontario, by telephone could he be convinced that a trick was not being played on him.

In reverberating upon this incredulity of stage folk the News, in a December issue, said: "The receiver is not a very agreeable instrument, at least in appearance. One can't tell from the looks of the telephone whether his singer is blind or not."

"This was quite baffling to Eddie Hall. He sang one or two of his most popular numbers, based on soprano and finally looked at the telephone in a manner that registered blind rage. And then he stuck his tongue out at the instrument, which seemed to relieve his feelings a lot, for he sang immediately to another selection.

#### Miss Apparatus of Invisible Audience

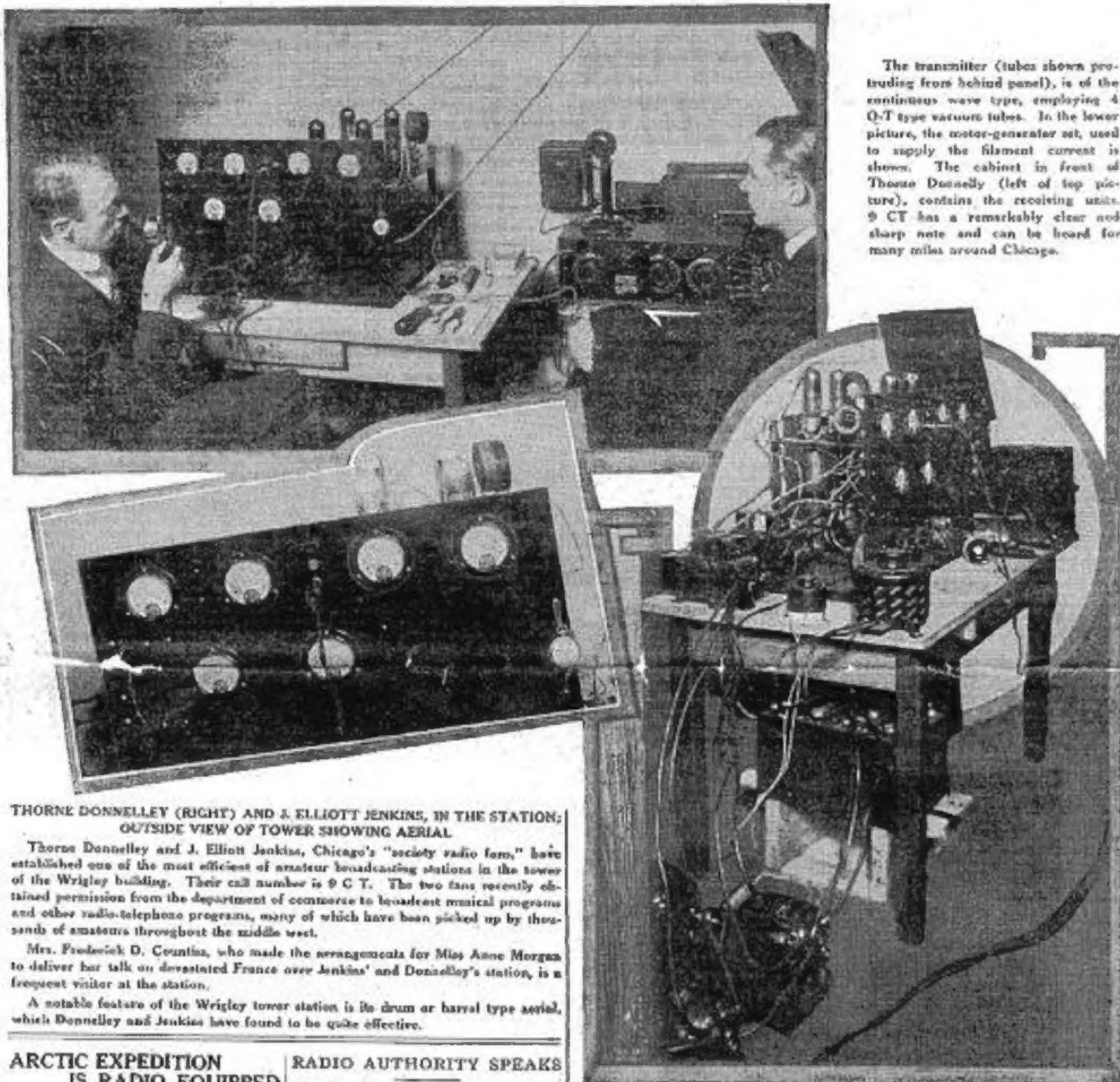
"In the case of Mr. Tinney, it was hard to convince that personage that this phenomenon was actually happening. He seemed to think someone was trying to spoof him. Again and again he demanded to know if the thing were on the square. It was that uncertainty. Of all the confidentials that appeared that week, Mr. Tinney probably suffered the most because of the lack of applause. The nature of his offering was such that it was almost necessary for him to have some demonstration of how folks liked what he was saying. This demonstration, however, is all cases was not long in coming, for at the intermissions of every concert some of the appreciative listeners in flashes back their thanks and asked for more."

(Continued on Page 6)



Fred A. Lathrop, Technical Director WWJ, Broadcasting Market Reports; Miss Fannie Brice and Frank Tinney (insets)

# FAMOUS NEW 9 C T AMATEUR STATION



THORNE DONNELLEY (RIGHT) AND J. ELLIOTT JENKINS, IN THE STATION; OUTSIDE VIEW OF TOWER SHOWING AERIAL.

Thorne Donnelley and J. Elliott Jenkins, Chicago's "society radio fans," have established one of the most efficient of amateur broadcasting stations in the tower of the Wrigley building. Their call number is 9 C T. The two fans recently obtained permission from the department of commerce to broadcast musical programs and other radio-telephone programs, many of which have been picked up by thousands of amateurs throughout the middle west.

Mrs. Frederick D. Coulter, who made the arrangements for Miss Anne Morgan to deliver her talk on devastated France over Jenkins' and Donnelley's station, is a frequent visitor at the station.

A notable feature of the Wrigley tower station is its drum or harrel type aerial, which Donnelley and Jenkins have found to be quite effective.

## ARCTIC EXPEDITION IS RADIO EQUIPPED

### Details of Trip to Be Broadcasted

New York, N. Y.—The arctic trip headed by Amundsen will leave Seattle, Washington, June 1st to travel through the northern seas for past the North Pole. This will be the first dash in history where the party will keep in touch with the outside world by means of a radiophone.

The expected trip will take from three to five years. The object of the trip is purely scientific in nature. They will cover two or three thousand miles through polar areas. Amundsen expects to emerge from the Arctic seas between Spitzbergen and Greenland. The ship will be equipped with an elaborate transmitting outfit and details of the trip will be broadcasted. They will also have receiving sets to keep posted on the developments at home.

### To Trace Freight by Relays

NEW YORK.—It is reported that a large brokerage house is anticipating the use of radio to tracing lost freight shipments between New York and points west. Charts of relay stations following the various railroads used will be organized. By relaying the numbers of the cars containing the shipments, their location at any time will be definitely established.

## RADIO AUTHORITY SPEAKS

### Detroit Engineers Hear Noted Speaker Last Meeting

DETROIT, MICH.—C. W. Hubbard, general engineer of Detroit, designer of Pontiac's filtration plant, and candidate for the national presidency of the American Association of Engineers, gave an address by radiophone from Detroit March 27 receivable over local amateur radio nets. It was announced here today by N. W. Stratton, secretary of the Pontiac chapter of engineers.

The address was delivered in Cass Technical High School, Detroit. Mr. Hubbard will outline the aims of the engineers' association for the benefit of the public. A. V. Parkhurst, a radio authority, also spoke.

The meeting was held under the auspices of the Detroit chapter of the American Association of Engineers.

### To Nab Bootleggers by Radio

WASHINGTON.—Prohibition Commissioner Hayes announced recently radio stations will be installed along the Canadian border in Michigan to apprehend the border "bootleggers." Such telegraph and telephone will be used. Grand Rapids, Detroit, Saginaw, and Gaylord will be reached from a station at Lansing.

The transmitter (tubes shown protruding from behind panel), is of the continuous wave type, employing 4 Q-T type vacuum tubes. In the lower picture, the motor-generator set, used to supply the filament current is shown. The cabinet in front of Thorne Donnelley (left of top picture), contains the receiving units. 9 CT has a remarkably clear and sharp note and can be heard for many miles around Chicago.

## WWJ FIRST PLANT

(Continued from page 5)

Another feature of the expansion of the News program in December last was the incorporation of local orchestral music. During the Christmas program, comprised chiefly of Christmas carols, speeches by Alex J. Grossman, governor of Michigan, the MU Rev. Fr. John P. McNichols, S. J., president of the University of Detroit, and Mayor James Couzens of Detroit were broadcast.

### Detroit Orchestra Breaks Into Radio

The first radio concert by the nationally-known Detroit Symphony Orchestra was broadcast February 22, 1922. The frequent concerts of this organization, now regularly broadcast by radio, have resulted in enthusiastic expressions of appreciation from people in every walk of life. Half of the United States now is the audience of the Detroit Symphony Orchestra, thanks to the radio.

### Special Set Built to Order

On February 1, 1922, a new Western Electric transmitter, with a 500-watt input and a radius of 1,000 miles was installed by the News. Reports of successful reproduction 2,000 miles away have been received since its installation. The new set was built to the special order of the News

and is the only apparatus thus far constructed by the manufacturer.

Telemobiles daily feed the radio department of the News from all corners of the globe, as to the efficiency of the new transmitting net. People have danced to Detroit radio music in Fort Pierce, Fla. Rhythmic dances have been heard in Calais, Maine. Omaha, Neb., reported that its residents enjoyed Babe Ruth's remarks in the News transmitter. Contributions for the Detroit Symphony Orchestra, during a recent campaign, have come from grateful admirers in a score of states.

Among the tokens of appreciation are messages from tropical Honduras, Central America, Alaska, Saskatchewan and Alberta, Canada, Cuba and from officers on Atlantic-bound vessels. Wyoming ranchmen write their thanks for the entertainments. The Detroit News radio has carried its messages into lonely places. Its radius has conclusively been proven to be infinite.

### Friends Hear Over Wire 'Phones

After calling your friend over the house telephone, place the receiver of the radiophone to the transmitter of the house telephone and he can hear the concert just as well as if he had a receiving set. Recently a New England telephone company has all its subscribers doing this to listen in on the Chicago opera.

## HISTORY OF RADIO STARTED IN 1885

### INDUCTION USED IN QUARTER-MILE RANGE

Vacuum Tube Oscillator Invented 1919  
Most Important Recent Development

Thirty-seven years of progress have made Radio telephone the chief source it is today. Starting with the use of the induction system in 1885, experiments were carried out in England which traversed the then remarkable distance of one quarter-mile. Gradual developments brought about improvements until in 1902 Dr. J. A. Fleming, consulting electrical engineer and Professor of Applied Science at London College, London, England, invented the two-element (filament and plate) thermionic vacuum valve detector. Probably the next most important development was the introduction of the third element, a grid, by Dr. Fleming's vacuum valve, by Lee DeForest, an American, in 1906. In 1912, Edwin H. Armstrong, an American and a student in Columbia University, developed the vacuum valve circuit which bears his name, and which has been responsible to a large degree for the popularity of radio-phono of late.

A few of the milestones in the progress of radiophono are as follows:

- 1885—Induction system used in England. Quarter-mile range attained.
- 1891—Conduction system experimented with in England. Transmission successful over distance of one and one-half miles.
- 1891—English collects experiment with induction system. Successful to depth of 336 feet from surface in galleries of mine.
- 1893—Induction system develops range of eight miles in England.
- 1895—Electrostatic system of A. F. Collins proves successful. Distance traveled, two hundred feet.
- 1896—Collins' electrostatic system range increased to three miles.
- 1898—Prof. E. F. Johnson's system covers range of twenty miles at Kiel Germany.
- 1906—R. A. Fessenden develops high frequency alternator system with range of twenty miles.
- 1906—Telefunken arc system used in Germany. Range of twenty miles attained.
- 1907—Fessenden improves high frequency alternator and increases range to 100 miles.
- 1908—Cohn-Jeante arc system used at Eifel tower station. Thirty miles range attained.
- 1908—Majorana develops arc oscillation generator and liquid microphone system. Communicates successfully from Rome to Sicily, a distance of 300 miles.
- 1909—ARC transmitter of T. P. Edison experimental over 100-mile range.
- 1909—Cohn-Jeante arc transmitters attains 100-mile range.
- 1910—H. P. Dwyer uses arc system to transmit from San Francisco to Los Angeles, a distance of nearly 400 miles.
- 1911—25-mile range between Nauen, Germany, and Vienna, Austria, successfully traversed by radiophone.
- 1912—Rome to Tripoli, 600 miles, covered by G. Vassalli, employing arc oscillator generator and liquid microphone.
- 1912—Nauen, Germany, station transmits 100 miles successfully.
- 1915—Oscillation wave transmitter covers distance between New York and California, 3,000 miles, successfully.
- 1915—Vacuum tube oscillator employed by Arlington Naval station in transmitting successfully to Honolulu, Hawaii, Naval station, a distance of 5,400 miles.
- 1919—Radiophono achieves range of 100 miles between aircraft in flight and 150 miles between an aircraft in flight and a ground station.
- 1923—British Isles and Canada linked by radiophono. Vacuum tube oscillator system employed.

### Newark Firm Installs 100-Mile Range Plant

L. Barnberger to Broadcast with New Station, WCR

NEWARK, N. J.—L. Barnberger & Co., of Newark, N. J., has completed the installation of a radio station of one kilowatt power with a station range of 100 miles and a potential range of 1,000 miles. The station is in operation during the daytime on each half hour and the call letters are WCR. It will be used for sending out educational information, lectures, entertainments and news features.

## U. S. Department of Commerce Gives Radio Amateurs Free Rein

### American Operators Prove Valuable Asset to Government in Time of War and Emergency—Aid in Development of Art

In no other country in the world is the amateur radio operator as free from restraint as in the United States. The only restrictions placed on his activities are with regard to wave lengths and licensing. This is to prevent confusion in the air waves.

The amateur operator is not necessarily a small boy. Many amateurs are mature men and women who possess most efficient radio stations. The term "amateur" operator is distinguished from "commercial" operator in so far as to designate operators who are in radio merely for love of the art.

The radio "novice" is one who has only a receiving set for the purpose of "listening in." Of amateurs there are more than 15,000, of novices, 600,000.

#### Amateur's Work.

To the amateur operator is due much of the credit for the position the United States occupies in radio work. The majority of the practical development of long distance radio communication has been largely the result of tests and experiments conducted by amateurs in determining the efficiency or inefficiency of equipment.

Nearly 50 per cent of the radio operators in the American military and naval services during the war were recruited from the ranks of amateur operators.

The amateurs have also been of valuable assistance to the Department of Commerce with its limited inspection service in helping to maintain the radio laws. They

### Tube Howling Stopped by Grounding Lining

#### Grounded Tin Foil Gives Stable Tube Action

There is one way to reduce the annoying howls and noise coming through the receiving set. Line the set with tinfoil, sticking it on with shellac. Do not use paint or glue as these are not good insulators.

If the sheet tinfoil cannot be obtained in any store it may be received from cigarette packages to serve the same purpose. Also place aluminum sheets between the various tubes and ground them the same as the tinfoil.

#### Theater to Employ Radio Music

DEO MOINES.—Fairies of the theater operated by H. P. Elbert here will soon be treated to music broadcasts. The broadcasts will substitute the regular orchestra. A receiving set with capacity enough to listen to KTW and KDLA is under consideration.

## RADIO SENDS NEWS TO COLLEGE PRESS

### UNIVERSITIES TO INSTALL CW PLANTS FOR DAILIES

President of College Editorial Association Is Interested Other Schools

ANN ARBOR.—To demonstrate the possibilities of the radio as a news commentator, the daily publications, the editors of the Michigan Daily, the official student publication of the University of Michigan, are conducting a series of experiments by transmitting news by radio conference colleges. Tests made during the basketball games have proved so successful that the Western Conference editorial Association, of which Brewster P. Campbell, of Detroit, managing editor of the Daily, is president, is now preparing to distribute the service to Iowa, Minnesota, Purdue, Wisconsin and possibly Chicago.

While the system is still in an embryonic stage, Michigan and Purdue have been able to handle reports with great facility, beating the wire system for more than a year. College editors place great hopes in the future of the radio service and the engineering departments of the schools have become interested in the mechanical end of the endeavor.

#### Amateur Interferes.

The scheme has not been developed without experiencing difficulties, the greatest of which was the interruptions caused by amateur operators who kept the older agitated during the early evening when news messages were sent. After that trouble was overcome by relating news at a late hour when the air was still, there remained the problem of convincing college heads that the expenditure of sums for new radio equipment was justified. These and many other difficulties the students have surmounted and they are now prepared to operate a daily radio news service to all colleges in the Middle West that have paper daily.

While the radio news system is not functioning regularly, it is nevertheless well organized and the editors are well prepared to handle the news service. The system is not functioning regularly because the stations involved had to insure continuous operation next fall. The Michigan Daily favors the installation in all colleges of equipment capable of using the continuous wave system that will permit the operating during the "busy" hours of the evening without difficulty and allow the work to be completed before 10 p. m.

#### Survey Equipment.

In the meantime college newspaper editors have decided to make a survey of their equipment and operators so that definite plans may be adopted for the development of the Western Conference Radio News Service at the May conference of the Western Conference Editors' Association.

### ANTENNA AND RADIOPHONE ON DOCTOR'S CAR



Dr. David Cottrell, Chicago Physician, at Right; At Left John Kinella, Who Installed Dr. Cottrell Radiophoning (Inset)

# Characteristics of Vacuum Tube Amplifiers

By Benjamin F. Messner

**Author's Note.**—Mr. Messner is graduate and teacher to many of our readers. He is still a student at Purdue University in 1916, he invented the Electric Dog, which by means of vibration coils and relays, would jump & bark. During the war he was associated with John Henry Rossmann, Jr., inventor of the radio-controlled torpedo. He is now working to improve problems in amateur and radio for the Brushwell-Bell Telephone Company, Chicago, and is author of "Radio Pictures," published by The National Company.

Mr. Messner will, for the first of his series of articles, take up the study of Hertzian, the theory of which must be comprehended in order to understand intelligently the operation of vacuum tube amplifiers. His series of articles will include: vacuum tube characteristics, high frequency amplification, audio frequency amplification and detail tricks of operation.

## INTRODUCTION

The subject of my paper, Vacuum Tube Amplifiers, is one of very great interest and importance in the art of communication. It is one branch of this art which, since its conception a dozen or so years ago, has grown with such meteoric rapidity and to such phenomenal proportions that it has left the others completely outdistanced and dethroned by comparison.

In the brief span of a few years, it has completely revolutionized radio reception; its achievements in wire telephony and in the realm of pure physics rank with the greatest of scientific works. A by-product of its development, the vacuum tube oscillator, is rapidly coming to the fore in radio transmission and perhaps soon to render the time honored spark system entirely obsolete. It is gradually pushing forward into the field of ares and alternators and amperemeters of units as powerful as the highest powers obtainable by these old systems may be expected.

I sincerely, fully appreciate the wonderful accomplishments of the little Aladdin's lamp, which we unconsciously use every day, let us strike our steps a few years.

## Operator Used First

When I was a boy of 12, I made a spark-gap-tube radio with that would work

from the house to the wood shed, and, if you too went through that stage of radio, you will believe me when I say that I was thrilled by the wonder of it. A few years later, about 1912, when I was a Navy operator in charge of the Washington station, the best Navy and commercial equipment used electrolytic detectors, or crystal rectifiers and telephone. The operating room jumped up quickly, then with the replacement of insensitive relays by highly sensitive telephone.

Then came the Fleming two-electrode valve, which was always "on a sensitive spot," and finally De Forest's three-electrode Audion. The insertion of that third, or grid, electrode in the two-electrode valve marks the beginning of the revolutionary process which is today such wonderful things in radio and other fields today. Soon the operation of the third electrode began to be understood, and the possibilities of using it as a throttle or control of large power with little effort were realized, and then came the vacuum tube amplifier.

## Value of Valve Appreciated

Since it consumes no appreciable power, this type of amplifier is practically a pure potential-operated device, and this is the secret of its ability to control relatively large currents when influenced by only minute changes of potential. Again, since it consumes no power, it cannot withdraw energy from the limited source to be amplified and for this reason, cannot damp out that supply energy. This is very important in receiving selectivity.

Since the controlled part, a high velocity stream of very minute particles called electrons, has no appreciable mass, there is no appreciable lag in its action. Its response to the control potential is instantaneous in the sense that a layer of less than one one-hundred millionth of a second may be so considered. Its ability to oscillate at wave lengths of only a few meters proves this conclusively.

## Old Amplifiers Gone

Other amplifiers had been prepared and used previously. The telephone amplifier, a combination of receiver and transmitter with their diaphragms mechanically connected, was used, and still is used to some extent, but the vibratory parts in comparison are excessively heavy and slow, visibility in relation the wave length of the exciting force, makes this amplifier a crude device.

Another type which I experimented with years ago is an electric generator, with field coils energized by the currents to be amplified and the armature yielding the amplified current. But this also is crude. While the controlled member, the armature of the generator field, has much better characteristics than the telephone

operator, the former in general also has several serious disadvantages.

## Field of Amplifier Broad

The technical aspect of vacuum tube amplifiers covers a very broad field of invention, research, engineering, and application. Many books have been written about it. A brief paper such as this might cover one of these divisions of the subject in a general way without going into details. I might even summarize the whole field in a very superficial manner, but neither of these kinds of treatment of the subject I am afraid would be quite satisfactory, answer the questions, or clear up the doubts in your minds about your own amplifier problems. What you want clarify, I believe, is the best general methods and circuits for particular purposes.

You want to know, I take it, what methods are available for high frequency amplification on long and short wave lengths, and the special difficulties of making them work; their various advantages, disadvantages and limitations. You are probably most interested in short wave length amplification, and want all of the information you can get on that; the features of transformer, impedance, and resistance coupling schemes.

Perhaps you would like to hear more about amplification by super-parallel bands, or a circuit for three stages of high detector and two stages of low frequency amplification with four tubes. Maybe you would like to increase selectivity by audio frequency limiting. You may not care to hear about tube characteristics, but I'm going to tell you anyway, as you may not understand their importance. These details of the general subject form the basis of my paper.

## PART I

### Electrons

The operation of vacuum tubes cannot be understood without an understanding of the fundamental laws of physics underlying it. These fundamental laws center around the electron theory of electricity and matter. Of course, all of you understand that the smallest unit or divisible part of matter is the molecule, and that this unit may consist of one or more atoms of one element, as in the case of an elementary substance like oxygen, or two or more elements, as in water, the molecule of which contains two atoms of hydrogen and one of oxygen. So far, this is the elementary physics and chemistry since Dalton's atomic theory.

Another property of substances, however, has been discovered which has resulted in the formulation of the Electron Theory. This theory explains the passage of electricity between two electrodes in a vacuum by considering an electric current to be a stream of negatively charged

particles called electrons. These particles exist in all substances. The atoms of these substances are considered to consist of further divisible units, namely a central positively charged nucleus surrounded by electrons in fixed orbits of rotation about it.

## Electrons Move Constantly

The number of these electrons and the geometry of their motion is responsible for the differences in different substances, all consisting of atoms of this type. The electrons are in constant rotation irrespective of the temperature of the substance. As the temperature rises from absolute zero (273° below 0, Centigrade), the molecules begin to vibrate, and at the boiling point of a substance, vaporization occurs. In addition to the electrons held together by forces within the atom, other free electrons exist in all substances, their number increasing with the conductivity of the substance. When a good conducting substance is raised to a high temperature, some of these free electrons near the surface of the substance attain an amplitude of vibration sufficient to move more than half the surface, and an electron evaporation occurs, similar to molecular evaporation in fluids when the space beyond their surfaces is not saturated.

This evaporation continues until the space surrounding the heated body becomes saturated; that is, until the combined charges of the free electrons in that space produce a space charge sufficiently large to repel emerging electrons back into the heated substance. This action again is analogous to molecular evaporation with evaporating fluids. If now, a positively charged body is brought near this saturated space, the negatively charged electrons will be attracted to the body.

## Accelerate Great Velocity in Vacuum

In air at atmospheric pressure, this can occur only to a very limited extent because of the presence of gas particles with which the electron collides. If, however, the two bodies be placed in a high vacuum, the large gas particles are removed and the electrons will be attracted to the positive electrode with a velocity depending on the difference in potential between the two. The mass of an electron is about one eighteen-hundredth that of a atom of hydrogen, which is the lightest of all atoms. Its diameter is less than one fiftieth of an inch ( $\frac{1}{50}$  centimeters). Its velocity may reach 30,000 miles per second in a high voltage tube.

It is now clear that an electric current can pass in only one direction through an evacuated space because only a positively charged body can attract the electrons.

**Editor's Note.**—The second of the series of articles by Mr. Messner will appear in the

# Inventor of Vacuum Valve Tells Its History

Grid Added in 1907

Probably no other single invention has done so much for radio as the Vacuum Valve. Its invention and development have opened countless doors in the realm of applied science. And yet, it is very simple in construction.

Dr. Fleming, inventor of the filament-plate, or two-element type vacuum valve, consulting electrical engineer, and professor of Electrical Engineering at the University College of London since 1903, has been in constant touch with the Radio world since its inception. In an article in the Manchester Guardian, Manchester, England, he says:

"The thermionic valve is an invention which is the keynotes of the arch of modern Radio telegraphy. Without it the kind of telegraphy would have a very restricted use. With it we can telegraph from England to Australia at the rate of a hundred words or more a minute. We can speak telephonically to flying aeroplanes or balloons 100 miles away, and twice high in the sky. We can talk across stormy oceans many hundreds of miles as easily and often, better than we can speak across the air by means of a telephone exchange. In short, the thermionic valve is an invention worthy to stand in the same category of merit as the steam engine, the power loom, the sewing machine or the pelvis engine. Moreover, unlike these inventions, it is extremely simple in construction."

## British Radio Commission Act

In the year 1912-13 an Imperial Radio Telegraphy Committee, appointed to consider the scheme of intercommunication between all parts of the British Empire, reported to Parliament the conclusions at which they had arrived. These were broadly as follows: (1) That the imperial radio stations should be established at distances of about 2,000 miles, connecting the various colonies of the Empire; (2) that the wireless system employed should be that making use of the thermionic valve; (3) that the stations be planned by a Radio Committee composed of experts and that the construction of these stations should be entrusted to the

Engineering Department of the General Post Office and the corresponding Indian and Dominion authorities.

The report of this Radio Commission has just been issued and forms interesting reading to experts in wireless telegraphy. The general reader will, however, find the technicalities unintelligible in the absence of a little explanation. The first question he will ask is: What is this thermionic valve to which the committee attaches so much importance?

## What Vacuum Valve Is

The thermionic valve consists merely of an incandescent electric lamp, containing a glass or silica bulb which is highly exhausted of its air and contains a filament of tungsten wire which can be rendered intensely hot by an electric current passed through it. It differs, however, from an electric lamp by having the filament surrounded by two metal cylinders. The outer one is a cylinder formed of a solid plate of nickel and the inner one is either a spiral of nichrome wire or else a cylinder of nickel gauze or network. These two cylinders do not touch each other or the filament, and they are attached to wires which are sealed through the wall of the bulb.

## Electrons Explained

To explain the operation of this device we must remind the reader that modern research has shown that the atoms of which material substances are composed are themselves formed of still smaller atoms of electricity called electrons. An atom of matter is a very small thing. If 100,000 atoms of copper or gold were put in a row, like marbles, touching each other the row would only be as wide. But an electron is still smaller. Its diameter is probably only one hundred-thousandth of that of an atom. Electrons are of two kinds, called positive and negative, and an atom is a sort of solar system in which a number of negative electrons revolve round a nucleus composed chiefly of positive electrons. In the case of metals some of these negative electrons escape easily from the atoms and probably jump about from atom to atom like bees in a

garden flying from flower to flower. The speed with which these free electrons dash about is many miles per second.

## Thermionic Action

The name we call an electric current in a wire is merely these free electrons as a whole drifting in one direction or surging to and fro without causing their irregular motion. When a wire, say, of tungsten is made very hot some of these free electrons escape from its surface, and this is called thermionic emission. If then we surround the hot wire by a cylinder of cold metal which is electrified positively, the escaping electrons are attracted to it, and the movement of negative electrons from the hot wire to the cold plate creates a thermionic current. Then, when negative electricity can pass from the hot wire to the cold metal cylinder but cannot pass in the opposite direction, with a lamp, with cylinder enclosing the filament, acts toward electricity as a valve in a pump acts toward water. It allows a flow to take place in one direction only. The writer of this article, who was the first to use in 1904 such an appliance in wireless telegraphy, called it an oscillation valve, a name subsequently changed to thermionic valve.

## De Forest Adds Grid

In 1907 an addition was made to it by an American inventor, De Forest, consisting in the interposition of a third, or metal wire between the filament and the metal plate of a Fleming oscillation valve. This addition formed the starting point for new developments by numerous inventors in England, America and France, which have finally given us the remarkable appliance called a three-electrode thermionic valve or electron valve, which cannot only detect but magnify feeble electric oscillations, and, more important still, can generate very powerful stationary electric currents if the circuit connecting the outer cylinder to the filament contains a battery or dynamo creating a steady electric voltage, and if this circuit is properly connected to another circuit joining the perforated plate or grid with the filament.

## Oscillating Electric Waves

In this form it is called a transmitting valve, and we can by it generate the very powerful high frequency to and fro alternating electric currents by an aerial wire which are necessary in Radio telegraphy or teletypes. These electric vibrations generate the electric waves which travel away through space from the aerial. The aerial wire, therefore, resembles a sort of lighthouse which is radiating invisible light. Transmitting valves are now made with silica or glass bulbs about the size and shape of a fly-gnat. A large number can be immersed together so as to generate enormous oscillatory currents.

At their great Carnarvon Radio stations on the site of Showers, Marconi's Wireless Telegraph Company have built a valve plant containing about sixty large valves, which can put into the great aerial wires currents of three or four hundred amperes. The electric waves so generated can be detected by suitable receiving thermionic valves at all parts of the habitable earth.

## Other Continuous Waves

There are two other methods of creating the continuous electric waves now used in Radio telegraphy. One of these is by means of a high-frequency alternator, which is a complicated kind of dynamo not very different in principle from the alternators used for producing the low-frequency electric currents employed in electric lighting. Machines of this kind are installed in the great wireless stations at Long Island and at St. Lucia, near Poria. Again, there is another method which makes use of an electric arc. The thermionic valve has, however, great advantages in point of first cost as against the high-frequency alternator, and it is superior to the arc generator because it gives a more pure form of electric wave, less contaminated by a mixture of waves of various lesser wavelengths, called higher harmonics, and has other advantages in economy of power in signalling.

# HENRY FORD A RADIO FAN; GETS LICENSE

Listens to Radiophone of Atlanta Newspaper—Bitten Badly by "Bug"

## Will Equip His Plant

Plans to Use Transmitter to Broadcast Program for Benefit of Employees

DETROIT, MICH.—While in a newspaper office in Atlanta, Georgia, the other day, Henry Ford learned in an a radio receiving set installed in the office of that publication, "Henry" was much pleased with the working of the set and left the impression that he had become quite a radio fan.

Henry Ford has many ways of keeping in the public eye other than making speeches, buying railroads and negotiating with the government for power dams and nitrate plants.

He now intends to install a transmitting coilset in the Highland Park plant to supply entertainment for his employees. He will use this as a means of putting "gag" into the workers. He recently made application through his counsel for a license to have an amateur transmitting set installed in the factory from which music may be broadcasted by radio. He is now authorized by the government to make this installation. It will be an outfit especially adapted for sending and receiving short-wave communications. It is planned to have radio sets in all of the houses of his employees.

## Business by Radiogram Is Perfectly Natural

Minneapolis Dealer Uses Radio to Connect Branches

MINNEAPOLIS, MINN.—Spectacular deliveries by airplane of a year or two ago have nothing on the part that radio service is destined to play as business affairs in the near future. Such equipment is already being used with satisfactory results by the Minnesota Auto Electric Co., of Minneapolis and St. Paul, to transmit business messages between their branch offices.

The company sent what is undoubtedly one of the best radio orders received by a Cleveland manufacturer, it being forwarded through the American Radio Relays League, a start-up battery company a few days ago. A great many of the service stations of the company throughout the country are equipped with radio receiving coils and quite a few with transmitting sets as well.

An order for 10 new radio batteries was sent from Minneapolis at 6 p. m. and first copied in Cleveland about 8:15 by Station A. U. N. The order was passed to Station E. R. R. Y., which is nearer the battery company's offices, where the message was copied and delivered. An acknowledgment of the order was radioed back from the battery company's radio laboratory (Station E. C. R. R.) at 6 the next evening, through Station E. A. U. N., and these messages by way of Toledo. The men in the order department at the company's offices say a radio order looks just like any other order on their books. They expect a great many more of the same kind before long.

## RADIO TO STOP UPRISEINGS

Wire Cutting Rebels in Mexico to Be Foiled

MEXICO.—President Obregon has installed a receiving set. While the set is not intended to receive very much broadcasting it has been very effective in stopping many uprisings. The first acts of the rebels is to cut all telegraph wires. They cannot do this with radio. To stop the wire cutting the government intends to install an elaborate system of radio. Every large city in the republic will have a government station according to the present plan.

## BLIND MAN JIGS TO TIME OF KDKA TUNE

MONTGOMERY, ALA.—Blind Bob Taylor, who sells candy and chewing gum on the streets of Montgomery, had quite an unusual experience Tuesday night at the radio station of the Montgomery Light and Water Power Company.

He was permitted to "listen in" and during the period he was listening a lively musical air was played in Pittsburgh which he heard distinctly during the time he danced a lively jig.

## SEAMAN OWES LIFE TO RADIO'S REMEDY

A SEAMAN on a freighter off the coast of Florida needed medical attention but there was no doctor aboard. The radio had brought assistance and the call was taken up by a surgeon in the Miami Hospital. A description of the symptoms was sent by radio and a simple remedy was received in return.

The return radiogram the next day said that the patient had a temperature of over 100 but had returned to normal.

## KING OF "FLIVVERS" LISTENS IN



Henry Ford is shown in the foreground listening in on the radiophone of an Atlanta, Georgia, newspaper. He was pleased at the performance of the apparatus and dedicated himself to instant radio "bug."

## EQUIPMENT IS BIG FACTOR IN RANGE

"How Far Can I Hear?" Only Answerable by Knowledge of Station

One of the first questions asked of the novice when he is looking over coils for the purpose of making a purchase is, "How great a distance can this radio receive?" This question is one that cannot be very well answered.

Radio can be compared to the effect one obtains while standing at the shore of a pond that is still and throwing a stone into the water. A circle of waves will start about the place where the stone dropped. If the pond is large enough there will be no waves perceptible at the edge. However, one could not pick out a single spot and say, "On this side the waves are visible and on the other side they are not visible. Therefore, there are none on this side."

This is much the same as in the situation of a receiving set, but with this important difference: The distance that a receiving set will receive widely will depend on the receiving set. A concert may be quite audible on one set and on another may not be heard at all.

A part of this difference may be due to different接收器, the degree of amplification employed and the sensitivity of the phones. A great deal of difference may be found in the batteries employed in supplying current to the set. Owing to the importance of the batteries there is one type especially made for the purpose and an automobile battery cannot be used with the best of results.

## SET YOUR WATCH BY TIME SIGNALS

NAA, Arlington, Sends Time Signals Daily on 2,650 Meter Wave Length

The naval radio station at Arlington C. N. A. A. broadcasts radio signals so that you can set your watch. The signals are flashed on a wave length of 2,650 meters, commencing at 11:55 a. m. and 9:55 p. m. (Eastern Standard) every day. The first signals at 11:55 a. m. and 9:55 p. m. are for the meridian 12 degrees west of Greenwich. Every tick of the standard clock in the Naval Observatory is transmitted by a dot. The twenty-ninth second of each minute is omitted as also are the last five seconds of the last four minutes and the last ten seconds of the last minute.

Thus, beginning at 11:55 a. m. and 9:55 p. m. the following procedure: 29 dots, one blank, 23 dots, five blanks, 29 dots, one blank, 26 dots, five blanks, and so on through the first four minutes. In the fifth minute 29 dots, one blank, 29 dots, ten blanks, and then the final dash denoting the hour.

## HOME NEVER LIKE THIS

Penitentiary Installs Station to Amuse Prisoners

JACKSON, MICH.—The prisoners at the Michigan state penitentiary are being amused by radiophones both at work and play. Recently a receiving set was installed at the prison and the 1,700 inmates listened in on the broadcasts. Two other sets will be provided for the prisoners while they are working in the clay pit and on the prison farm.

## CONTINUOUS WAVE PROVES EFFICIENT

### SPARK TRANSMITTERS NOT FAVORED NOW

Difference Between Two Methods Easily Understood—Radiophones Use Continuous Wave

The general efficiency, range, selectivity and simplicity of the continuous wave or CW transmitting circuits has given great impetus to radio telegraphy. Its low cost as compared with the old style spark transmitter is another factor in its popularity. With only fifty watts most messages have been successfully sent across the Atlantic Ocean.

The difference between the continuous wave and the diminishing or damped wave transmission is comparatively simple and easily understood. In CW transmission, a wave of constant amplitude, or with each peak as high as its predecessor, is generated. The wave is perfectly uniform and travels through space without change, its maximum range of travel being dependent upon the initial power at the source, or point of generation.

The damped or discontinuous wave, generated by a spark transmitter, might be likened to the action of a pendulum without a source of power to keep it swinging. The amount of time between the pendulum's beats is the same each time, but the space covered by the swing diminishes with each swing. In other words, the peak of the discontinuous wave diminishes in height each beat, while the CW peaks, like the amounts of space covered by the pendulum in a clock that is running, are over the same height.

#### Generation of CW

Although there are several distinct methods of generating a continuous wave, the vacuum tube oscillator is probably the most satisfactory. In this method, the three-electrode vacuum tube is used. It will be noticed by users of this type of tube for receiving, that oscillations when the filament current (controlled by the rheostat) is increased to a certain point, a ringing or singing note, will be heard in the telephone receiver. At this point the phenomenon is known as self-oscillation of the vacuum tube.

In the vacuum tube oscillator, the design of the tube and the circuit used are particularly for the purpose of aiding this self-oscillation or generation of CW. The wave is impressed on the antenna of the transmitting station, from which the radiations are picked up by the antenna of the receiving station.

#### Selectivity of CW

The CW is extremely selective, or in other words, its wave length is very sharp or constant. This means that a receiving station must be adjusted to the identical wave length of the CW transmitting station if the signals of the latter are to be heard. On account of this selectivity of CW transmitters, there is very little interference when two CW stations are transmitting at the same time with wave lengths but a few meters apart.

Indeed as all the power transmitted by a CW station is impressed on one sharp wave which is not damped but continuous, there is great economy of power. The average CW transmitter, compared to the average spark transmitter having the same power level, will have an operating range of over five times that of the latter.

#### CW Is Explained

Interrupted continuous wave (ICW) transmission is also possible with the vacuum tube oscillator. Indeed, to employ a CW set for code radio telegraphy, the ICW is necessary in order to create an audible tone in the telephone at the receiving station. The ICW is obtained by use of some mechanically operated interrupter such as a synchronous, which "cuts" the continuous wave up into "pieces" of uniform length and of such number per minute, that they are within the limitations of pitch of the human ear. Ordinarily, CW oscillations occur over 10,000 times a second, a pitch greatly beyond the maximum pitch audible to the human ear.

Radiophone transmitting stations are really CW generators which send out an ICW wave sound waves hit the diaphragm of the phone transmitter. The sound waves modulate the wave form and cause interrupted continuous waves upon which have been impressed the forms of the sound waves generated by the sounds of the transmitting station, be they the result of voice, music, or whatever everyday sound.

## Chairless Church Has Radio Choir

The congregation of a certain church hears the choir sing by radiophones. The members of the congregation assemble on a week day evening in the church and the choir gathers at a local music store. By means of the broadcasting station and a receiving set installed in the church, including an amplifier, the congregation hears the voices of the choir in its accustomed place in the church.

# Radiophone Broadcasting Stations

*Corrected to April 10, 1922. This List  
Will Be Corrected Weekly. Form  
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**Explanation.**—In the following tabulation, RADIO DIGEST will attempt each week to make it easy for the reader to hear all the broadcasting stations in the vicinity. Hence the alphabetical classification, by states and then by cities, is used. Stations whose schedules of operating hours are known (those having C, N, R, etc., under "Program" in the following tabulation), are listed at the end of the table, alphabetically by call letters, under the head "Station Schedules." Having picked a station, use the "Station Schedule" list to learn its operating hours and what you will hear during the various hours. The following abbreviations are used to the "Program" column of the tabulation: A—agricultural bulletins, etc.; C—concerts; E—entertainment; F—fun; M—health reports; I—instruction radio; L—opera or musical; M—market reports; N—news; P—police; R—religious; T—time signals; V—variety or entertainment; W—weather reports. An asterisk (\*) designates code telegraphy.

State and City	Call	Wave Lengths	Miles Range	Program	By Whom Operated
Alabama:					
Montgomery .....	WGH	360; 485	.....		
Arkansas:					
Pine Bluff.....	WOK	360	.....		
California:					
Berkeley .....	KFU	360	.....		
Gridley .....	KGC	360	.....		
Hollywood .....	KLP	360	.....		
Los Altos.....	KIS	360	.....	C; N.	
Los Angeles.....	KOG	360	.....	Not known.	
Los Angeles.....	KQL	360	.....	Not known.	
Los Angeles.....	KYI	360	1,000	C; M; W; N.	
Los Angeles.....	K2C	360	.....	N; C.	
Monterey .....	DDV	360	.....	Not known.	
Oakland .....	KLS	360	.....	C.	
Oakland .....	K2M	360	.....	N. C.	
Oakland .....	KZY	360	.....	C; K; N.	
Pasadena .....	KLB	360	.....	Not known.	
Pomona .....	KGF	360	.....	Not known.	
Sacramento .....	KVO	360	.....	C; N.	
San Francisco.....	AGI	360	.....	C; L.	
San Francisco.....	KDN	360	.....	C; M; N; W.	
San Francisco.....	KGB	360	.....	Not known.	
San Francisco.....	KUO	360	.....	Not known.	
San Francisco.....	KVN	360	.....	Not known.	
San Francisco.....	KOW	360	.....	C.	
San Jose.....	KJO	360	.....	C.	
Stockton .....	KWG	360	.....	N; M; C.	
Stockton .....	KJJ	360	.....	C.	
Colorado:					
Denver .....	KIZ	360; 485	1,000	N; W; G.	
Denver .....	.....	360	.....	C.	
Denver .....	.....	360	.....	T; W; N.	
Connecticut:					
Hartford .....	WQB	425	900	C.	
New Haven .....	WCJ	360	.....	Not known.	
D. of C.:					
Washington .....	WDM	360	.....	R; L; C.	
Washington .....	WDW	360	.....	Not known.	
Washington .....	WJH	360	.....	I; V; C; H.	
Washington .....	WWX	1160; 1980*	.....	W; M.	
Washington .....	SYN	360	.....	L.	
Georgia:					
Atlanta .....	4CD	200-375	.....	N; C; L.	
Illinois:					
Chicago .....	KYW	360	1,000	C; L; N; M; R.	
Chicago .....	WBU	360	.....	P; F.	
Rock Island .....	WOC	360; 485	.....	Not known.	
Indiana:					
Indianapolis .....	WLK	360	.....	C; V; N; L.	
Indianapolis .....	WOH	360	.....	Not known.	
Richmond .....	WOZ	360; 485	.....	Not known.	
Iowa:					
Des Moines .....	WGF	360	.....	Not known.	
Iowa City .....	9YA	360	.....	M; N.	
Kentucky:					
Louisville .....	9ARU	200	.....	N.	
Massachusetts:					
Medford Hillside .....	WGI	360	1,000	N; C; L; I; H; R; M.	
Springfield .....	WBZ	360	.....	C; N; L; R.	
Michigan:					
Detroit .....	WWJ	360; 485	1,000	C; V; N; M.	
East Lansing .....	WHW	485	.....	M.	
Minnesota:					
Minneapolis .....	WLB	360; 485	.....	W; M; C; N.	
Missouri:					
Jefferson City .....	WOS	485	.....	M.	
Kansas City .....	WOQ	360; 485	500	M; W; C; L.	
Nebraska:					
Lincoln .....	9VV	360	200	C; N.	
Omaha .....	WOU	360; 485	.....	Not known.	
Omaha .....	WOW	360	.....	Not known.	

State and City	Call	Wave Lengths	Meter Range	Program	By Who Operated
New Jersey:					
Jersey City	WNO	500	500	C; N; L.	Jersey Journal
Jersey City	2AI	200	..	Not known.	Jersey Review
Newark	WCR	300	..	Not known.	J. Baudinger & Co.
Newark	WJZ	900	2,000	N; L; C; W; A. R.	Westinghouse Electric & Mfg. Co.
New Mexico:					
Roswell	.....	300	..	Not known.	Roswell Gas & Electric Co.
New York:					
New York	WDT	300	..	Not known.	Ship Owners' Radio Service
New York	WIX	360	..	Not known.	Dr. Forest Radio Telephone & Telegraph Co.
New York	WYCB	1430	..	N; C.	Amateur Radio Reserve
Rochester	WHO	300	..	Not known.	Rochester Times Union.
Schenectady	WLY	300	..	Not known.	General Electric Co.
Schenectady	WRL	300	..	Not known.	Cornell College.
Ohio:					
Akron	WFX	200	200	C.	Radiant State.
Cincinnati	WLW	300	..	Not known.	Crosley Mfg. Co.
Cincinnati	WMH	300-485	300	C; N; L; W; V	Precision Equipment Co. (W 108XB)
Cleveland	WEK	200	60	C.	Warren R. Cox (W 108 AC-4)
Columbus	BBYV	200	..	C; N.	Electrical Specialty Co.
Columbus	SYO	275	..	T; M; L; N.	Ohio State University
Dayton	WFO	300-485	..	Not known.	Rike-Kamler Co.
Dayton	WA-1	300	..	Not known.	U. S. Army.
East Cleveland	WL-2	300	..	Not known.	U. S. Army.
Hamilton	WRK	300	..	Not known.	Doran Bros. Electrical Co.
Toledo	WHU	300	..	Not known.	Wm. B. Dees Co.
Toledo	WPK	300	..	Not known.	Service Radio Equipment Co.
Toledo	WZZ	300, 485	..	Not known.	Marshall Grinker Co.
Oregon:					
Portland	.....	300	..	Not known.	Ballock & Vredens.
Portland	.....	300	..	Not known.	Northwestern Radio Mfg. Co.
Portland	.....	300	..	Not known.	Ship Owners' Radio Service
Pennsylvania:					
Harrisburg	WGI	300	..	Not known.	Hack's Electrical Store
Philadelphia	WGL	300	..	Not known.	Thos. F. J. Howlett
Pittsburgh	KDKA	300	2,000	N; C; L; R; V; T; M	Westinghouse Electric & Mfg. Co.
Pittsburgh	KQV	300	750	C.	Doubleday-Hill Electric Co.
Pittsburgh	WRB	200	200	Not known.	Newspaper Printing Co.
Rhode Island:					
Westerly	.....	300	..	C; L.	Whitall Electric Co.
Texas:					
Dallas	WRR	400	..	N; W; C; R.	Police & Fire Signal Department.
Dallas	.....	300	..	Not known.	Radio Equipment Co.
Washington:					
Seattle	KCG	370	..	N; C; V; H	Northern Radio & Electric Co.
Seattle	KHQ	370	..	Not known.	John Wasmur.
Seattle	XJR	370	..	Not known.	Vincent J. Kraft.
Wisconsin:					
Madison	WHA	360-485-800	500	W; C; N; M.	University of Wisconsin.
Canada:					
Montreal	.....	1,200	200	C; N; L.	Marconi Telegraph Co. of Canada, Ltd.
Toronto	.....	400	..	Not known.	Canadian Independent Telephone Co.
Toronto	.....	1,200	..	Not known.	Marconi Telegraph Co. of Canada, Ltd.

## *Station Schedule*

## Your Directory—

**T**O AID the beginner and to help him realize full benefits from his receiving station, RADIO DIRECT has compiled the foregoing list of radiophone broadcasting stations. To use the "radiophone directory" to its maximum advantage, the reader should note the broadcasting stations nearest and attempt to tune them in at the wave lengths given.

Broadcasting stations with regular schedules of operating hours are given below. Doubtless many such stations have been omitted just much as their schedules have not been reported to RADIO DIGEST. These will be added as reported. The kind of program, broadcasted by a station during its various operating hours is also given.

In fact, the reader, by means of RADIO DIGEST'S radiophone directory, can pick out his favorite program, the station he desires, or the time which he prefers to listen in. Time, in the following list of stations having schedules, is always given in the time used at the city at which the station is located, as for example "KYW Chicago, Illinois," indicates that the schedule of KYW is given in Central Standard time, the time which is in use in Chicago.

The stations are listed alphabetically by call letters. The list, therefore, acts as an index to the foregoing table.

**K.Q.T., Pittsburgh, Pa.**  
Daily except Mondays and Sundays.  
and except ~~Wednesday~~ ~~Wednesday~~,  
Wednesday and Friday, 12 M. to 1 P.  
2 P. to 3 P. ~~Wednesday~~ ~~Wednesday~~, 1 P. to 3 P.  
and except ~~Wednesday~~ ~~Wednesday~~

H. Q. V., Pittsburgh, Pa.  
H. Q. W., Box 3000, Okla.  
Wichita Falls, Tex., P. O. 31 - correct

X V Q. Baccalaureate, Calif.  
Daily except Sunday, 12-2 P.M. to  
except 1st Sat. week Wednesday also

**Saturday, 1-11-2 1927 at 21' elevation.**  
**E W G. Marshall, Calif.**  
Dots except Friday, 1-11-2 1927 at 21'.  
Dots with dashes, Friday and Saturday, 1-11-2 1927 at 21' elevation.

KTJ, Los Angeles, Calif.  
Daily except Sunday 4:00-6:00 P.M.  
except Sunday, noon and weather  
Monday, Tuesday and Saturday,  
4:00-6:00 P.M. same program

R T W. Chicago, Ill.  
 Daily except Saturday, 9-10 A M., 10:14  
 A M. 10:15 A M. 11:15  
 A M. 11:15 A M. 12:15 P M. 1:15  
 2:15 P M. 3:15 P M. 4:15 P M.  
 5:15 P M. 6:15 P M. news and markets  
 7:30 P M. 8:30 P M. stock market summaries, 10  
 P M. or later, 9:30 P M. 10:30 P M.  
 regular, 11:30 P M. 12:30 A M. Sundays.

**H. C. Los Angeles, Calif.**  
Daily except Saturday 10 A.M. to 11  
noon and on Tuesday, Wednesday and  
Friday, after 10 A.M., otherwise.

**K K K, Oakland, Calif.**  
Daily except Sundays, 7:15 A. M. to P. M.  
except Tuesdays, 7:15 A. M. to  
Sundays 7:15 A. M. to 12:30 P. M., except

**STATION SCHEDULE**

*(Continued from page 11)*

W H K. Springfield, Mass.  
Daily except Sunday, 12 M. P. M. and  
1 P. M. Saturday, 12 M. P. M. and  
1 P. M. Concert, 1 P. M. Sunday.

W H K. Washington, D. C.  
Monday, 12 M. P. M. Concert, 1 P. M. and  
1 P. M. Saturday, 12 M. P. M. Concert.

W H K. Montgomery, Ala.  
Daily, 12 M. P. M. Concert, 1 P. M. and  
1 P. M. Tuesday, Thursday, and Sat-  
urday, 12 M. P. M. Concert, 1 P. M. and  
1 P. M. Sunday, 12 M. P. M. Concert.

W H K. Boston, Mass.  
Monday, 12 M. P. M. Concert, 1 P. M. and  
1 P. M. Wednesday, 12 M. P. M. Concert,  
1 P. M. Saturday, 12 M. P. M. Concert.

W H K. Milwaukee, Wis.  
Daily except Sunday, 12 M. P. M.  
and 1 P. M. Concert, 1 P. M. and  
1 P. M. Saturday, 12 M. P. M. Concert.

W H K. Atlanta, Ga.  
Daily except Sunday, 12 M. P. M.  
and 1 P. M. Concert, 1 P. M. and  
1 P. M. Saturday, 12 M. P. M. Concert.

W H K. Cleveland, O.  
Tuesday and Sunday, 12 M. P. M.  
Concert.

W H K. Washington, D. C.  
Tuesday, 12 M. P. M. Concert,  
Wednesday, 12 M. P. M. Concert,  
Thursday, 12 M. P. M. Concert,  
Friday, 12 M. P. M. Concert, 1 P. M.  
Saturday, 12 M. P. M. Concert.

W H K. Newark, N. J.  
Daily except Sunday, 12 M. P. M.  
and 1 P. M. Concert, 1 P. M. and  
1 P. M. Saturday, 12 M. P. M. Concert.

W H K. Philadelphia, Pa.  
Tuesday, 12 M. P. M. Concert, 1 P. M.  
Wednesday, 12 M. P. M. Concert,  
Thursday, 12 M. P. M. Concert,  
Friday, 12 M. P. M. Concert, 1 P. M.  
Saturday, 12 M. P. M. Concert.

W H K. Chicago, Ill.  
Daily, 12 M. P. M. Concert, 1 P. M. and  
1 P. M. Saturday, 12 M. P. M. Concert.

W H K. Jersey City, N. J.  
Daily, 12 M. P. M. Concert.

W H K. Kansas City, Mo.  
Daily, 12 M. P. M. Concert, 1 P. M. and  
1 P. M. Concert, 1 P. M. and Weather, 1 P. M. Concert.

W H K. Hartford, Conn.  
Tuesday, Wednesday, and Thursday,  
12 M. P. M. Concert.

W H K. Dallas, Texas.  
Daily, 12 M. P. M. Police news, 12 M. P. M.  
and 1 P. M. Concert, 1 P. M. and 1 P. M. Concert.

W H K. Detroit, Mich.  
Daily except Saturday, 12 M. P. M.  
and 1 P. M. Concert, 1 P. M. and 1 P. M. Concert.

W H K. Washington, D. C.  
Daily, 12 M. P. M. and 1 P. M. Concert,  
12 M. P. M. and 1 P. M. Concert.

W H K. Atlanta, Ga.  
Tuesday, Wednesday, and Thursday,  
12 M. P. M. and 1 P. M. Concert.

W H K. Columbus, O.  
Tuesday, Wednesday, and Thursday,  
12 M. P. M. Concert.

W H K. Akron, O.  
Monday, Wednesday, and Friday,  
12 M. P. M. Concert.

W H K. Louisville, Ky.  
Monday, Wednesday, and Friday, in  
evening, 12 M. P. M. Concert.

W H K. Iowa City,  
Iowa, 12 M. P. M. Concert.

W H K. Tampa, Fla.  
Daily, 12 M. P. M. and 1 P. M. Concert.

W H K. Miami, Fla. (Hotel Glazebrook).  
Tuesday, 12 M. P. M. and 1 P. M. Concert.

W H K. Cedar, N. Y. (M. G. A.).  
Daily, 12 M. P. M. Concert.

W H K. City (Metropolitan Hospital).  
Tuesday, 12 M. P. M. Concert.

W H K. Montreal, Canada (Montreal Station).  
Tuesday, 12 M. P. M. Concert.

W H K. Tucson, Calif. (Tim Incorporated).  
Daily except Saturday, 12 M. P. M. and  
1 P. M. Concert.

W H K. B. L. (Whitall Pier, Del.).  
Daily, in evening, concert.

**Impossible to Receive Broadcasts  
With the Lightning Switch Grounded****Important Instructions to Follow in the Construction of Antenna  
Given Beginners—Securing of Proper Wire a Big Factor**

Note that insulating contacts are being broadcasted by some stations and the beginners in the field will find it difficult to separate, the first question most usually arises as to what to do in the interest of safety. We begin with the best part of an antenna is there to prevent the user from getting a shock. It is necessary to see that the wire or the antenna is a safety. Some people think that they can make up many the best option, while others switch to perfectly true, but they must be used the broadcasting station in case they are using your own equipment. If they connect over to an antenna aerial their own safety is more than one hundred percent.

For receiving, the wire that is the antenna is just as efficient a form as the radio has been the safety for the user in use. It has a tendency to break by static or ground, which is another

After many years of experimenting with various types of metals the metal that I found was the best for use in the construction of my antenna.

The metal will provide the entire metal if insulated copper wire is selected. But it does present difficulties in insulation because the metal is used, although aluminum has a tendency to the crystalline structure. Copper seems to have good rating in its ability to conduct, but it is very expensive.

**Make Happy Hours  
for the Bedridden****Broadcast Amuse and Inform**

The radio is bringing the real world to bedridden and disabled to be patients houses where it is being used to comfort the patient in his bed. The weary patient often suffers from some condition in their condition every day, and which is living in the real world and the difference between they cannot get over.

The real one, in a hospital or home equipped with a single set, not more than the head, sides and rear, the sides of the patient's world. A radio of lectures, music, songs and other entertainment to the patient. The patient becomes more of concern of the family as well as a real live report from the hospital. The patient can get a better understanding of the care of the radio.

While you, the patient, can get a radio of music, educational enter, the church services from a local church, the radio can be used after leaving hospital, hospital, hospital and the patient can hardly know what education she really has.

The same radio can be used at the end of the year and all the year in addition to the patient's world, but better. He is soon being enabled by use of the radio to entertain.

**WIRE TELEGRAPH TO STAY****An T. & T. Engineer Declares Radio  
Will Only Supplement**

LANSING, Mich.—F. L. Rader, engi-  
neer for the American Telegraph & Tele-  
graph company declared recently that  
executive editor of the A. T. & T. tele-  
graph has no intention of ever  
attempting to replace, but that  
within the next few years would de-  
pend on the development of the telephone  
and the telegraph to take over.

He announced as follows at the hearing  
before the state public utilities commission  
in the Michigan State Telephone  
company's request for permission to add  
a permanent rate. Mr. Rader blamed  
the lack of money accompanying radio  
communications for the utility to replace  
the lines. He maintained that state  
commission, which had not been experienced  
with handicapped radio transmis-  
sions.

Approximately the entire day was taken  
up with arguments concerning the financial  
relationship between the A. T. & T.  
Western Electric and the Michigan  
Tele. Industries over that testimony  
of much the same description would be  
offered again.

When the lead is to follow to the west  
the A. T. & T. will be followed  
as the service goes on to follow to  
present operation. The end is going to  
remain the same until the fall of  
the year, which is now over 100  
by the National Board of Utilities  
and the A. T. & T. will be

done by advertising  
100 feet of  
the best ground wire required  
and the best ground that can be had  
and also test and test 100% of  
over 100% of the lightning protection  
installed, as you may have to pull a 100%  
line for the insurance to come in.

**Send Your Pulse to  
Heart Specialists****New Discovery Permits Long Distance  
Diagnosis by Broadcasting  
Heart Beats**

WASHINGTON, D. C.—RECENTLY  
there were the first successful demon-  
strations of heart beats. These are the first  
that have been done in patients that recovered from the  
operation.

A different time was given before a  
radio to play in the heart disease  
demonstration in Washington recently.  
A heart transmitter was placed over the heart  
of the patient most difficult. The  
radio was then turned on the sensitive  
area of the heart and vibrations in  
the character of heartbeats. These  
vibrations were fed up through the  
conducting of a series of electrical  
currents. The current takes when

the heart was relaxed a longer  
duration. Long speaker that during the  
entire duration by the heart tone during  
which the heart beat was increased for the benefit of attending doc-  
tors.

Later experiments along the same lines  
have proven, it is claimed, that these  
currents can be transmitted by radio over  
great distances. This means that if the  
radio goes over the living thousands  
of miles away can diagnose and rec-  
ognize what has been done. For  
example, a man goes to a hospital in a  
small city in the South West and by  
means of a heart specialist at New York  
comes to the conclusion of his illness  
as regards a treatment or illness by  
means of the operation.

**HEARS WIRE TALK  
WHILE LISTENING IN****Switchboard Reportman Hears  
Local Gossip**

PITTSFIELD, Mass.—A switchboard re-  
porter of Pittsfield, continued to have dia-  
logues on account of listening to the tele-  
phone. This is not a new idea, but he  
had to read a newspaper between two  
calls to the switchboard operator in  
order to get a break. The reporter  
stated that he has discovered three oper-  
ators. The girl who is still operating  
between calls is located at the office of the  
house and it was a small room attached to  
the office. She sat on the roof.

Mr. C. W. Morrison, also in charge  
of the Pittsfield telephone in Washington,  
stated that there is nothing which  
can stop this other. He was in  
the office room between a telephone  
line and the switchboard. He said, "It is  
quite possible and very likely to hear  
the conversation of the telephone girls  
at the instant a call comes in. In fact,  
most girls carrying all the telephone  
lines and to whom the operators can be  
called upon to those that know how  
to handle them. If one of the girls  
is forced to leave the room, she  
will have to go to the office."

We heard the same for the telephone  
in our country all the year around  
and the same. We can hear over the  
radio over the ocean they claim  
travel and travel over 100,000 miles  
mentioning stations all around the world. Some  
experts believe millions, millions even  
the radio transmitters are running over  
the air by the year.

**BOSTON CITY HALL  
HAS LOUD SPEAKER****MAMMOTH NEW RECEIVING  
EQUIPMENT INSTALLED****Special Opening to Be Arranged  
Between Mayor Curley and  
Hylan Over WJZ**

PROVIDENCE, R. I.—CITY HALL, and  
other public buildings, will be opened  
tomorrow for inspection. The  
new equipment installed in a big  
auditorium, will be shown to the public  
and the public will be allowed to  
see the new equipment.

The new station will be set up in the hall  
and the public will be invited to inspect  
the new equipment installed in the hall  
and the public will be allowed to see the  
new equipment installed in the hall.

This will be started early. Mayor  
Curley will be the first to inspect the  
new equipment and the public will be  
invited to inspect the new equipment  
installed in the hall. The public will be  
allowed to see the new equipment installed  
in the hall.

Arranging Special Opening  
Arrangements are now being made by  
William J. Curley, mayor of Providence,  
and his wife, Mrs. Curley, to have  
Mayor Fiore of New York, and Governor  
John H. Englehardt, of New Jersey, speak  
at the opening. The opening will be  
held in the auditorium of the hall.

There will be a large number of  
people in the hall, and the public will be  
allowed to see the new equipment installed  
in the hall.

**VAUDEVILLE HOUSE  
TO GET BROADCASTS****Gardenburg Theater to Install Ra-  
dio Equipment for Broadcasts**

STALBOMING, Calif.—Circus fans have  
been invited to the Plaza theater, prepared for  
the installation of the latest and most  
modern radio equipment available. They will  
visit the theater to see the galleries of  
entertainment in the famous high class variety  
show, the newest and most wonderful forms  
of entertainment known to science. The  
auditorium will be fitted to receive an  
enormous variety grand opera, concerts  
and masses of noted men, with a radio  
available to each in all of the auditoriums.  
It is expected the new equipment will  
be installed in the auditoriums of all the  
various sections of the theater, so that  
fans of the show will be able to see the  
entertainment over the radio and the  
auditoriums will be filled with the best of  
stage performances over the best of  
radio equipment.

**Panama Hears WWJ Concert  
with World's Largest Station**

DETROIT, Mich.—I got a letter 100  
miles off the coast in a boat in the Gulf  
of Mexico, and I wanted to have the  
news of the Panama Canal. I took  
the news by the news station in  
New York, and the news by the  
radio station in New York. We have  
the largest radio station in the  
world, and the Panama Canal has  
been closed for a week.

I am highly interested in the Detroit  
radio station, by name, "The Detroit  
High School Boys' team." I am told  
that in radio, WJZ, we bring in  
every day the news from the  
expedition, and words and pictures  
are broadcasted to the world. This  
is created in radio if the best and  
best way.

We heard the same for the telephone  
in our country all the year around  
and the same. We can hear over the  
radio over the ocean they claim  
travel and travel over 100,000 miles  
mentioning stations all around the world. Some  
experts believe millions, millions even  
the radio transmitters are running over  
the air by the year.

**KYW Listeners Give to France**

NEWARK, N. J.—Held a benefit  
meeting organized by 1000 listeners  
from the broadcasting station K  
WY, Newark. The last benefit received  
from the group was \$1000. Miss Morgan  
("The dollar that counts") had  
received \$2000 the day before.  
"The dollar that counts  
was sent because I have never received  
such a large sum."

# Simple Instructions for the Beginner

By Harry J. Marx

Last of last Friday on the operations of radio we reported some of our Radio Fan, concerning the activities of listeners interested in the home and which people are trying radio outlets at the present time. This issue, continuing the discussion of radio circuits, is a new job for the amateur operator. This article is briefly intended to describe the operation of a few of the simple circuits and also to furnish a series of comments on the usual common questions that arise. Space is lacking to go very much in detail, so this will be the first of a series of articles covering the operation and description of all the apparatus in the different radio circuits.

## The Crystal Detector Set

Very few realize the similarity of the crystal detector set to the vacuum tube sets. If we keep the similarity in mind, we will avoid the many pitfalls that menace the path of the radio amateur from the crystal detector stage to the tube set. Fig. 1 shows us the hook-up of one of the simplest of Crystal Detector Sets. The aerial ground connection to the water pipe, two slide tuning coil, fixed condenser, detector and head receiver make up the list of necessary apparatus. The cost of this outfit would run about \$10 to \$20 and its simplicity, it has the advantage of being easily converted into a vacuum tube set. The next step the radio fan contemplates. This crystal set has a receiving range of about twenty miles, more or less according to the atmospheric conditions of the vicinity and the effects of local interference.

In order to make the theory of the circuit as simple as possible, we will describe the Radio Waves as a series of waves, travelling through the air, walls of the buildings or other structural obstacles. These waves are like vibrations of the strings of a musical instrument. These electrical vibrations are absorbed by the aerial and are fed to the tuning coil with its adjustments and then to the detector. The detector is simply a one way valve, that will permit the passage of the vibrations going in one direction, it acts as a sieve in straining through the desirable elements. Having converted the vibrations into a series running in one uniform direction, we pass them to the head receiver, which takes the waves emitted to the ear. Like a hot water heating system our electrical circuit must have its return pipe and from the receiver it flows on through to the ground. The condenser is connected across the receiver to give capacity, that is to say it acts somewhat as the reserve tank that gives us a steady flow and strengthens the tone of the message.

## Tuning

Tuning this set means that we want to adjust our apparatus to the proper wave length in the same way that we adjust the string of a violin until we get the right note to match the key of a piano or a tuning fork. The first step is to see that our crystal detector is adjusted properly. To do this we can take a set of dry batteries and the dial to act as a tachometer. The circuit would be the same as for the bell ringing operation except that we add the detector to the circuit, as shown in Fig. 2. Now adjust the counter-shutter or wire on the crystal until the point of contact is obtained where the bell operates best. Keep this adjustment and hook up the apparatus. Take the right slide of the tuning coil and set it to the bottom. Then slide the left one or aerial connection back and forth until the signals are loudest. Now repeat the operation with the right slide and tuning to completed.

There is one point that is not usually realized by the new beginner, a crystal detector set has but very little tuning range. The wave length is limited, and the tuning range varies but little. If then the natural wave length and the location is favorable to the reception of the nearest broadcasting station, the reception will be clear enough to satisfy the first craving of the fan. Location and weather conditions may however make the crystal detector set impractical and the results will be rather discouraging. In this case, the amateur should avoid any further waste of time and money in experimenting further with the crystal set. Take a set and start in with a vacuum tube set, it will save money in the end and will give unquantifiable results.

## Vacuum Tube Set

If your results fail to satisfactorily discourage the crystal set fan, he soon begins to look around to find what apparatus he will require to convert his outfit to the vacuum tube type. In Fig. 3 no effort has been made to make the outfit as cheap as is consistent for good results. Where possible the former instruments are utilized, and at the same time the circuit is of such a type that more can be added as the pocket allowance permits. The additional parts are one or two variable condensers, a grid leak and condenser, "A" and "B" batteries, filament rheostat, vacuum tube and socket. The hook-up is shown in Fig. 1. Now for comparison let us follow the

## LIST OF APPARATUS

### CRYSTAL DETECTOR SET

100 Foot Copper Aerial Wire  
3 Insulators  
12 Joints  
1 Pencil  
1 Water Pipe Ground Clamp  
100 Foot No. 14 Insulated Wire  
1 Two-Slide Tuning Coil  
1 Crystal Detector  
1 Galena Crystal  
1 Set Head Receivers  
2000 ohms or better

### VACUUM TUBE SET

*Additional apparatus required:*  
1 or 2 Variable Condensers  
1 Grid Leak and Condenser Unit  
1 Vacuum Tube Set  
1 Tube Socket  
1 Filament Rheostat  
1 6 volt, 10 ampere Storage Battery  
1 22 volt "U" Battery  
*Amperage of Storage Battery could be over than 60.*

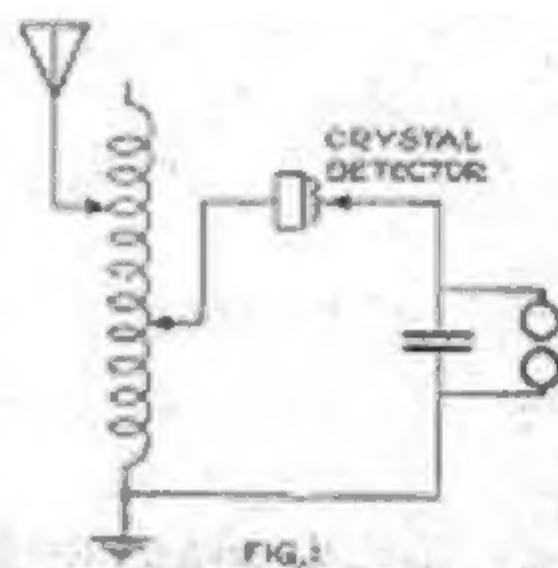
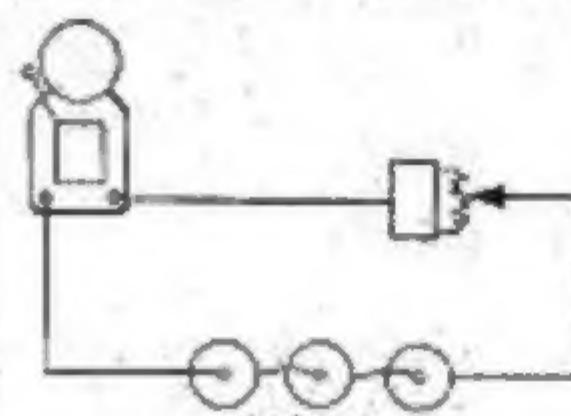


FIG. 1  
path of the waves or vibrations through the vacuum tube set.

We notice now that the waves coming from the aerial and are led through to the tuning coil and also to the grid leak and condenser. The condenser serves the same purpose as before while the grid leak gives a slight negative value to the current and also allows the vibrations to travel through. That is to say, it allows only a certain amount to pass through depending upon the capacity or resistance of the two parts. From there it goes to the grid of the tube, now tube operation requires considerable technical language to explain and the reader can read through other articles in the magazine for details, we will take the simplest method of describing the path without the confusion of attempting an explanation of the theory. When it reaches the grid, it passes through the battery, which supplies additional current to help operate the receiver. Now in addition, we also have the filament which you will notice is hooked up to the tuning coil slider besides its separate battery for operation and the rheostat to control the flow of current to the filament. This filament current now aids in reducing the grid current by adding to the vibrations going to the plate and on through to the receiver. The main point then in the vacuum tube set is the fact that our tube acts as a valve that not only accomplishes as much as the crystal detector, but in addition, by adding the strength of the batteries, magnifies the impulses that are received. A condenser can be hooked up in parallel across the receiver as before but the flow of the vibrations is well under control and the advantages are not as apparent as before. The purpose of the condenser connected across the tuning coil is to act as an absorber for the outside interference currents that will creep in. It will catch these and partially prevent



them from going over to the rest of the circuit. The condenser shown in dotted line between the aerial and the tuning coil is inserted at the option of the operator. If the aerial is long enough and the ground is favorable, it may be necessary to cut down the natural wave length. Therefore this condenser will tune down but not up, a common error among amateurs.

water or carbon disulfide its usefulness will be restored.

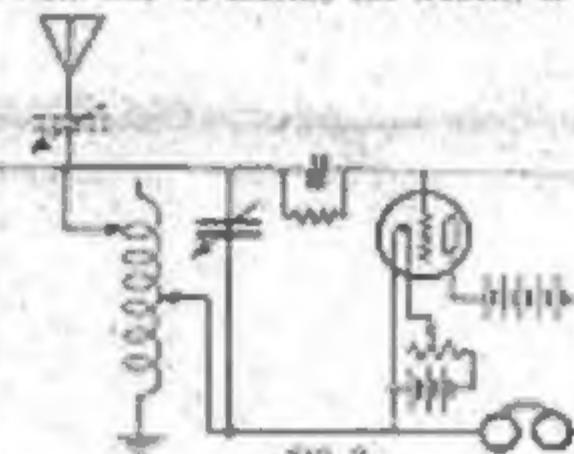
## Vacuum Tube Burn

In the same manner, numerous questions are asked concerning the vacuum tube and its handling requirements. Strange to state people will persistently ask whether the house lighting current can be used instead of the wall battery. Try taking an automobile headlight and put your house lighting current through it, the experiment won't be quite as convincing and will convince you that it can't be done. The vacuum tube filament is designed to operate on a six-volt circuit, similar to the usual auto headlight bulb and excessive current will simply melt the filament. The maximum amperage of current, not pressure, should be one ampere. Even this is merely the maximum limit, but it will be found that about half of that will be sufficient under the usual operating conditions. As the tubes grow older, it will be noticed that they demand more current for operation.

After about four months' use, it would be advisable to remove the tube and place it in an oven. Heat the oven gradually until the glass gets just too hot to handle and then bake at this temperature for about fifteen to twenty minutes, then let it cool very slowly. It will then be found to have renewed sensitivity and will require less current to operate. Of course after repetition even this will fail in time, but you have increased the natural life two or three times with the extra care you have taken.

## Bowling

Many amateurs are continually complaining of bowling. Off hand it is difficult to state the exact cause as it may be the result of a number of things. Examine the wiring and see if it is neatly done, avoid too much slack in the wires which means untwisted tangled loops that would create induced currents in the circuit. Possibly the filament current is too strong. Hence other stations tuned to the same wave length may be causing the trouble, or oc-



tensionally the triplex line and wires edges by if parallel to the aerial or feed in will cause trouble. A high tension cable close to your aerial especially if it runs parallel, will spoil the best reception. Very often, due to high steel buildings or peculiar natural conditions an amateur will find himself in a dead area, or at least one where the reception encounters consider- able interference. Sometimes this can be remedied by raising the aerial higher or making it longer—if not, the answer would be to grin and bear it or try working with some friend that is more fortunate. As a parting word, don't be disheartened because you find things are not just right at the start. Radio demands a little hard work and plenty of pep and push!

P. S. wishes to know: How high must the antenna be?

Answer—From thirty to sixty feet is high enough for amateur stations.

H. J. L.—What is the natural period of an antenna consisting of four wires, 110 feet long and 40 feet high? Answer: About 114 metres for the T type and 100 metres for the L type.—John Bailey.

William Russell—Can you tell me what causes my tubes to get all blue inside when I use them? Answer: If you have reference to a incandescent vapor, it is caused by the rise of excessive current heating up the glass and metallic parts of the bulb. If there appear any other colors it is because the tube is defective.

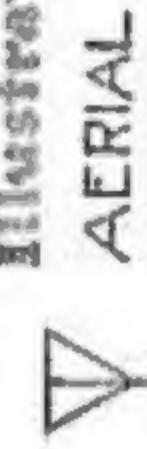
Z. Berman—Can I hear daily concerts with a pair of 15 ohm receivers, a galena detector, a fixed condenser, a two-slide tuning coil and a two-wire 30-foot aerial? Answer: No. You will need a more powerful pair of phones, about 1,000 ohms. Your aerial is too short by about fifty feet and if you live more than twenty miles from the broadcasting center I would not advise assembling this set.

Levi G.—I live on the second floor of a three-story apartment. Would there be any objection to running an aerial between the posts on the back porch, to be taken down when not in use? It's only sixteen feet long enough for receiving purposes? Answer: You can put up a very good aerial on your back porch as suggested, but make it longer than sixteen feet if you can. Sixteen feet will give results with a good outfit, but if you can make it longer it will work better.

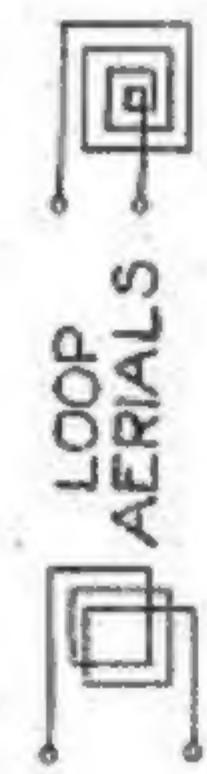
# Radio Digest

Illustrated

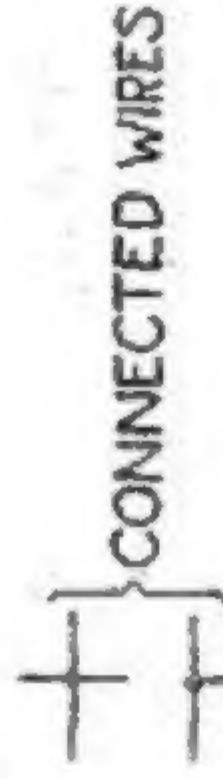
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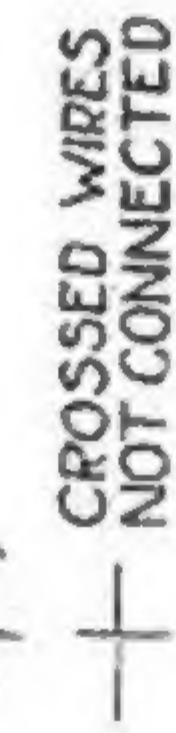
FOLD



SINGLE POLE, SINGLE  
THROW SWITCH  
SINGLE POLE, DOUBLE  
THROW SWITCH



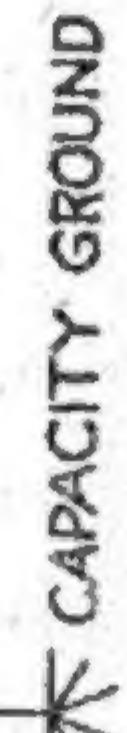
CROSSED WIRES  
NOT CONNECTED



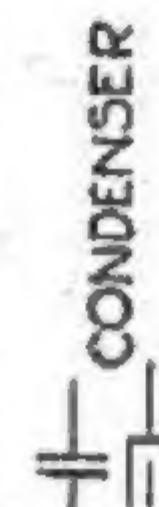
'B' BATTERY 22½  
VOLTS OR UP.



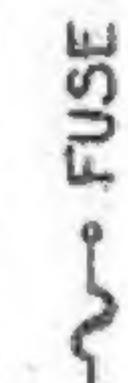
'A' BATTERY 6 VOLTS



BINDING POST  
OR CONNECTION



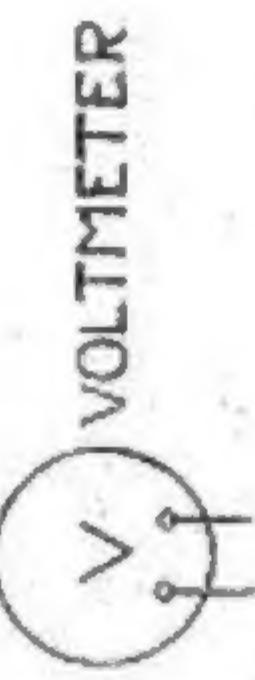
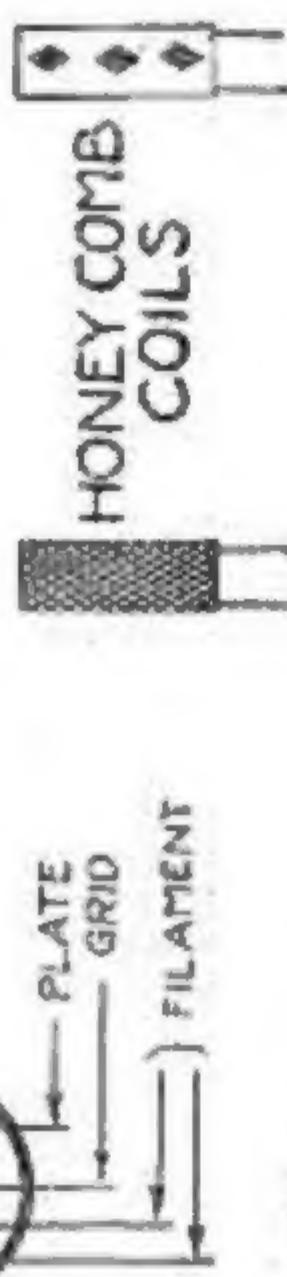
VARIABLE  
CONDENSER



KEY



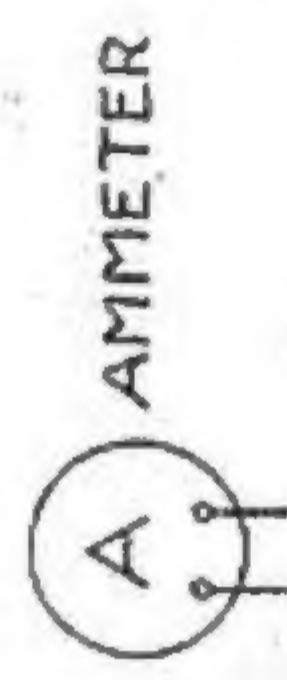
VACUUM TUBE



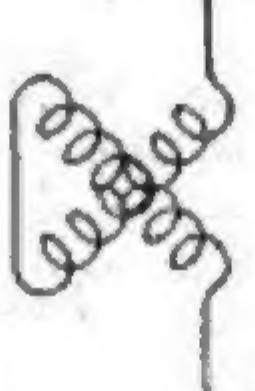
VOLTMETER



RHEOSTAT



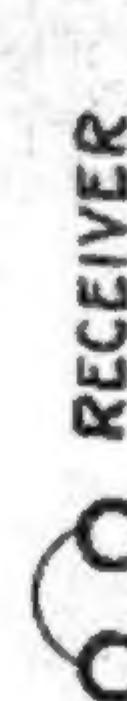
AMMETER



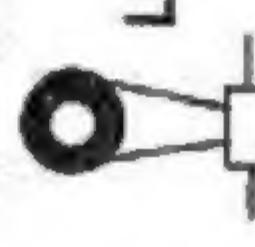
VARIOMETERS



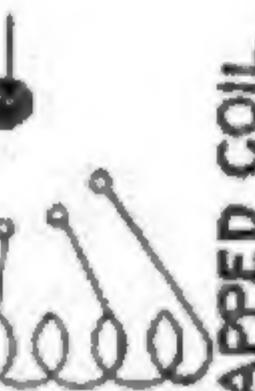
TRANSMITTER



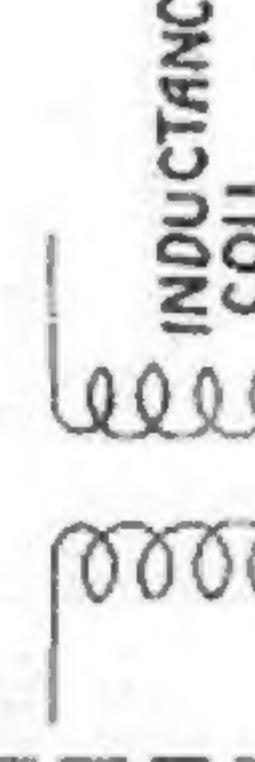
RECEIVER



LOUD SPEAKER



CHOKE COIL



INDUCTANCE  
COIL



TAPPED COIL

# Questions and Answers

**John Tolson writes:** "I am not allowed to use an outside aerial. How do I ground the inside wires that run around the molding and where do they end?"

**Answer:** Connect one end of the wire to the aerial connection on your instrument, run the wire up to the picture molding, laying it out nice and straight so that it cannot be seen. The distant end is not connected to anything. The aerial must not be grounded, but the ground wire from your instrument can be connected to a radiator or water pipe.

**W. Scheppeit, Chicago, Ill., asks:** "Where can I get No. 14 insulated copper wire?"

**Answer:** Try any electric supply house.

**John Kline asks:** "(1) Will you please tell me if there is any possibility of connecting a tuning coil with a reading set, and how? (2) Do you have to have a license to send any distance?"

**Answer:** (1) A tuning coil such as used in a receiving set would be of no use in your sending outfit. A sending set is tuned with an oscillation transformer and condenser. (2) Absolutely yes. You are not allowed to do any sending unless you have a license. You can receive, but not send.

**Radio Editor:**—Is a loose-coupler as good as two variometers and a varicoupler for receiving? J. A. BURPEE.

**Yes.** The only reason variometers and a varicoupler are used is on account of the small amount of space required when placed in a cabinet.

**Radio Editor:**—What is the best size of wire to use in winding a tuning coil? R. E. COOPER.

**Mother No. 22 or 24 silk or cotton covered wire.** After winding the coil stretch it and let it dry. When it is thoroughly dry scrape the insulation off with a sharp knife where the coils turn.

**Radio Editor:**—I have a loose-coupler, crystal detector and fixed condenser. My aerial is 25 feet long, and about 10 feet high. Can I improve my set without using a vacuum tube? G. E. GILMAN.

By connecting a variable condenser in your aerial circuit it will both improve your set and also bring in signals much clearer.

**Radio Editor:**—I am using an Aerola Jr. receiving set but seem unable to pick up KDKA using a loop aerial. Can you suggest a remedy? R. WALKER.

**Why certainly!** Get a vacuum tube set and put up an outside aerial about 100 feet long and 200 feet high, and then you can pick them up.

**Radio Editor:**—The writer has a relative who lives alone with two deaf and dumb nieces, about thirty miles from Chicago, and has little opportunity of coming in contact with the outside world. What sort of an outfit is suitable to receive concerts and other information? Are concerts sent out every day? F. L. G.

**Answer:** An outfit with vacuum tube detectors, complete with headphones and batteries can be purchased for about \$25.00 at electrical supply or department stores. Concerts are sent out every evening from the Westinghouse K. V. H. station on the roof of the Commonwealth Edison building, together with news bulletins, news features and speeches.

**Radio Editor:**—I am using an amateur bulb with a storage battery that will give a total output of 15 volts. I am using only six of these volts, however, and when the cells get low, I use another cell, making eight volts, and when this cell runs low I have the battery recharged. Will it make any difference in recharging the battery? H. S.

**Answer:** You certainly are taking a chance when you put eight volts on the filament of your tube, even if the cells are nearly exhausted. Incidentally, using the battery when it is nearly discharged, is not the best thing for it, as a storage battery should never be allowed to run entirely down. The best way is to use only six volts and then if you have a charging outfit, charge the battery up about every third night if it is used every evening. Just connect the charger on before going to bed and in the morning the battery should be fully charged. It is well to test with a hydrometer, though, as an overcharge is almost as bad for the battery as leaving it fully discharged. Keep the battery at about the same charge and it will last for years.

**Radio Editor:**—Please tell me if a regenerative receiver will work well using a telephone line as an aerial. V. K.

**Answer:** It is not advisable to use the telephone line. Put up a single wire aerial about 100 feet long for the best results.

**Q.** Could the cardboard tubes you mention in the diagrams of the radiophone receiving set be enclosed in the outside and inside without interfering with the efficiency of the set?—Ralph Nyt.

**A.** It is not advisable to shelter the tubes after the windings are on. This does what the electric engineers call "increasing their capacity" and makes the

tuning beat sharp. Tubes may be shielded before winding if desired, but it is not necessary.

**Is it necessary to have a government license to operate a receiving set?** L. T. R.

**It is only when you desire to transmit messages or broadcast that Uncle Sam requires you to take out a license.**

**Radio Editor:**—Will you kindly explain the meaning of the regenerative receiver? I am using honeycomb coils on a long wave set. Do the coils replace the tuning unit or are they connected in series with the aerial? A. R. C.

**A regenerative receiver is one that uses the vacuum tube with the plate circuit of the tube fed back to the primary coil. It is not possible to get regeneration without a vacuum tube. Your honeycomb coils are regenerative if you use three of them at once. They are the tuning unit with the exception of the necessary variable condensers.**

**Thomas Hall—Can I improve my range by placing a 45-plate variable condenser**

**noise stretched directly under the aerial and about four feet from the ground.**

**Alva Stoen—What is meant by natural wave length of an aerial, and how is it calculated?**

**Answer:** Natural wave length is the length of the wave, usually measured in meters, produced by the aerial's capacity and inductance. Roughly speaking, the natural wave length can be calculated by multiplying the length of the aerial by 44, and to change from feet to meters divide by three. This will give you the natural wave period of a single or double wire horizontal or vertical aerial aerial.

**William K. Stoeck—Kindly let me know what I would need and the construction of a loud speaker (improved style), suitable for a set equipped with a loose coupler, A. F. detector and two stage regeneration amplifier.**

**Answer:** It is not practical to make a home-made magneto receiver. A good receiver may be made by coupling a single sensitivity receiver, such as the Baldwin or Brown, to a horn or to your phonograph. You can purchase a coupling device that is made for the purpose.

**The radio frequency amplifier is undoubtedly best.**

**L. M. says:** "I hear a constant hum in my receiver. The set works fine but the noise spoils all the music. What shall I do about it?"

**Answer:** Undoubtedly there is a high-voltage power line running near your home. If this is the case try placing the antenna at right angles to the power line and you will find that the interference will cease.

**Radio Editor:**—Can I use insulated wire for the aerial? RICHARD KENNARD.

**Insulated wire will not make any difference if used for the aerial.**

**Radio Editor:**—I have a crystal set that works very well, but once in a while howls and hums. What is the cause of this? PAUL H. THORIN.

**You may be located near some transmitting set that is testing and this is probably what you hear. You may also have a loose connection somewhere, as this will sometimes cause peculiar noises in the receiver.**

**Radio Editor:**—Can a good receiver be set up using honeycomb coils? Will it work as well as a high-priced regenerative receiver, using two varicones and a varicoupler? Is the De Forest circuit using two primaries and one secondary as good as either of these? W. M. H.

**The difference between the set using the honeycomb coils and the regenerator using the two varicones and the varicoupler lies in the fact that the former will give better results on longer wave lengths, while most of the latter type of set will not work on wave lengths over 400 to 450 meters. The honeycomb coil set is all right, but for short wave lengths the varicoupler and variconer circuit is hard to beat. These circuits are both regenerative, while the De Forest circuit you mention is not regenerative. All three circuits are excellent in their fields, and it is a hard matter to compare the relative merits of them. Each is supreme in its class.**

**Radio Editor:**—Please tell me where Station 7 X A 1 is located? W. D.

**Station 7 X A 1 is the experimental house of W. J. E. It is the call used when they are testing.**

**Radio Editor:**—How many watts will the set using the DeForest circuit take in this set a single circuit? Is it used for performances? RADIO.

**This set will tune to any wave length if the owner wishes to buy the necessary honeycomb coils. These cannot be made at home with any degree of satisfaction. It is not a single circuit. It is an excellent set if made correctly.**

**Radio Editor:**—Can I add two steps of amplification to an Aerola Jr. set? Whose call letter is W R W? R. P. A.

**You may add amplification to any set using an audio detector. W R W is located in Tarrytown, N. Y.**

**Radio Editor:**—How can I stop the party across the street from sending out code messages while I am listening to the carrier? L. MORRIS.

**You cannot stop an amateur station if he is transmitting legally with a license and is on the right wave length. He has just as much right to the air as you have. Remember that there are many amateurs who have been in the game for years, and some of these men are carrying on important relay traffic. They have a great deal of money invested in sets, and, as a rule, these old timers do not care much about the broadcasting. It is only fair for the beginner to remember that some of these very amateurs whom they are now blasting with the interference are the very men who made the radiophones possible as well as the sets that receive it. A little courtesy shown by both sides will serve to clear up a great deal of misunderstanding. The broadcasting station has no right to keep the air all the evening, and neither has the amateur. At the present time the broadcasting stations are sending out lengthy programs that sometimes extend until nearly midnight. This sort of a performance is hardly fair to the amateur, who has to get off some important messages. Put yourself in the other fellow's place and do not think that you can have the air all to yourself over more than anyone else can.**

**K. C. B. wants to know: What would a complete receiving set to hear music cost?**

**Answer:** A complete hand-made, short-wave regenerative set, including aerial, could be tracled for \$25.00.

**R. F. R. asks:** I am using a gas pipe for a ground connection and am not getting good results. What shall I do?

**Answer:** A water pipe makes a good ground. Scrub or sandpaper the pipe before pulling on the ground clamp.

**L. A. O. inquires:** Which is the best type of aerial?

**Answer:** A one-wire antenna about 100 to 150 feet long is appropriate for receiving while a 4 or 6 wire cage antenna is best for transmitting.

## An Invitation—

WHEN "Stumped" write the Question Department of **RADIO DIGEST**. A self-addressed, stamped envelope should be enclosed **ALWAYS**, as not all answers can be published. Only those of general interest will be printed in these columns. Other questions will be answered by mail.

When your question is of a highly technical nature and cannot be readily explained, send sketches and diagrams along with it.

The services of a trained staff of Radio Engineers are at the command of every reader of **RADIO DIGEST**. Don't hesitate to send in your troubles and let **RADIO DIGEST** worry about them.

**RADIO DIGEST**, however, reserves the right to refuse to answer any question which might lead to litigation.

In my ground circuit? Answer—To increase the wave length range of the circuit connect the condenser across the primary. If you place it in the ground circuit you will decrease your range. If anything.

**Radio Editor:**—I want to purchase a receiving set and yet I am told that the new broadcasting stations are going to be on a higher wave length and I do not want to get a set that will not tune in high enough to receive them. Will you please advise me about this matter? J. W. H.

Up until the present time this department has no information regarding the wave lengths at which the new stations are going to operate. However, the stations at Post Woods are operating on a wave length of 1,150 meters, and if you want to hear this station you will have to see that you get a set that will tune that high. At the present time very few of the regenerative sets will tune that high.

**Radio Editor:**—Which is best, two steps of amplification and a Magnavox or three steps and an Amplivox? What voltage should be used in the third step?

C. L. NOLTE.

The Magnavox will give the best results, but all these metal boxes are more or less "heavy." For real results a wooden box should be used. This lesson was learned a good many years ago by the phonograph industry, but the manufacturers of radio loud speakers have had to learn it all over again. This department does not recommend the use of the third step or amplification as it usually is very "noisy" unless made exactly right.

**Radio Editor:**—Where can I purchase drawings for making a receiving set? I want one that will receive at least 400 miles. A. B. NELSON.

Most of the publications of Radio magazines carry drawings showing how to make sets. Several good sets have also appeared on these pages. None will tell how. No one can give you a drawing of a set with a guarantee that the set will work 400 miles. Such factors as the builder and the operator as well as local conditions under which the station must work have too much to do with the matter.

**John Owen:**—"What shape counterpoise shall I use in conjunction with a cage aerial 100 feet long and 10 feet high?"

**Answer:** Construct a fan-shaped counter-

poise consisting a standard hexagonal hook-up that is coupled to the secondary of an audio receiver and also to receive F. D. Z.

2. Is there any advantage in using 110 volts on the oscillator through a filter?

3. Is an A. F. amplifier suitable for the oscillator and a W. E.-V. T. 1 in the detector?

**Answer:** 1. Use two 1,000-turn coils for primary and secondary, with some small coil of such as 15 turns to couple the heterodyne. The heterodyne may have two 100-turn coils. You probably would get better results using an Armstrong hook-up with the other half as a step of amplification.

2. There is no advantage. It might work, however. The Navy tried this many years ago but has discarded it.

3. The tubes you mention are excellent for the purpose. Use 15 volts or more for the plate.

**Q.** Our house is over 20 feet high. If I stretch the antenna from the house to a tree I will have the desired length, but the wire will be only one foot above the roof. Will this affect the instruments?

W. E. H.

**A.** If it is a thin rod it will scarcely affect your instruments. But in any event you are courting trouble by such an arrangement. Better try to arrange your antenna so it will not traverse the entire roof.

**Q.** Would like to know if the antenna wire has to be bare or can it be insulated? Can it be less than 20 feet long? And can the ordinary electric light wires be used? C. B.

**A.** Antenna can either be bare or insulated, but it is not advisable to have it any less than 100 feet. Ordinary electric light wires can be used. Recommended 1-22 copper wire.

**Q.** My house is 20 feet high. A tree 20 feet distant is 10 feet high. With an antenna stretched from the top of the tree to the top of the house is it satisfactory?

H. J. M.

**A.** Such an antenna would work, but it would be better if you could arrange to make it 100 feet long.

**J. J. asks,** which is best for amplification, radio or audio frequency.

**Answer:** Audio frequency with two or more steps of amplification will, however, with the radio frequency there is no bawling and any number of steps may be used.

# The RadioWorld in Pictures

**JOY FOR BEDRIDDEN**—While confined to bed, J. D. Cannon, Chicago, plays up records and keeps up interest of own mind. U. & U.

**"BLACK JACK" PERSHING RADIO FAN**—General "Black Jack" an important army mattoe uses radiophone in his office. U. & U.

**RING RECEIVER**—A. G. Blaebert, 18, Elizabeth, N. J., inventor. Umbrella is ground. U. & U.

**MAKING A "PHOTOCASE"** case into a 40-watt receiver. U. & U.

**LYRE-SHAPED LOOP ANTENNA**—Radio antenna "dressed up" for park concert was. Design, C. M. Dalessandro, U. S. A. U. & U.

**THE VOICE FROM THE AIR**—Twelve Mts. Name Persell says it was great the first radiophone on S. S. Mohawk. U. & U.

**"RADIO OF STATE"**—Gov. of State makes station of radio box. Musical instruments furnish "entertainment" with others of state. Int.

**"SHE LOVES ME, SHE LOVES ME NOT"**—Executive motor invented by Prof. Maxson Detheridge, Alabama. U. & U.

**HATCH BOX LIGHTS WAY**—Sister K. R. Moran, 12, and brother show how great oil works. U. & U.

**JAZZ DANCING ON "I-953"**—Dancing popular on "I-953" road when dancing broadcasts are not wanted. U. & U.

**RADIO JAZZ LATRET IN DANCING**—Hansie Vanderbilt, New York, furnishes queen with musical dance broadcast. U. & U.